TECHNICAL MANUAL

OPERATING AND MAINTENANCE INSTRUCTIONS WITH PARTS LIST

POWER MEASURING TEST SET MODEL 4037 from SN 190001

NSN 7Z 6625-01-286-3591

General Microwave Corporation
5500 New Horizons Boulevard
Amityville, NY 11701

Contract No. N00104-88-D-D060

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SECTION I

INTRODUCTION

1-1 GENERAL.

This technical manual contains the information required for operation and maintenance of the Power Measuring Test Set, Model 4037 (Figure 1-1). This information consists of the description and general theory of operation of the Test Set; instructions for preparation for use and installation, operation, maintenance, and preparation for reshipment and storage; and a list of replaceable parts to support maintenance.

1-2 DESCRIPTION.

The Power Measuring Test Set, Model 4037 hereinafter referred to as the Test Set (Figure 1-1) is used to measure microwave power over a frequency range of 0.01 to 40 GHz and is comprised of a Power Meter and three Power Heads stored in a carrying case. A list of those components which comprise the Test Set is contained in Table 1-1. Depending upon the frequency range of the measurement, the applicable Power Head is selected and plugged into the input connector on the Power Meter front panel. The Power Heads (Model N4240A-5, K4240C-5 or A4240C-5) cover a frequency range of 0.01 to 18 GHz, 18 to 26.5 GHz or 26.5 to 40 GHz, respectively. The Power Meter indicates the average power absorbed by the Power Head. Each Power Head contains a thin-film thermoelectric (tft) element which responds only to the rms value of the input signal regardless of its waveshape. As a result, pulse, amplitude-modulated and cw signals can be measured with equal accuracy. The OUTPUT connector on the Power Meter rear panel provides the means for connecting an external digital voltmeter or recorder to monitor Power Meter readings.

Primary power (115 VAC or 230 VAC) for the Test Set is applied via the AC line cord and the 115/230V power module on the Power Meter rear panel. A voltage selector card in the power module is used to select either 115 VAC or 230 VAC operation. The Test Set can also be battery-operated with an optional rechargeable battery pack installed in the Power Meter.

Table 1-1. Equipment Supplied

Component	Model no.	Part no.
Power Meter	476-5	18856-P1
Coaxial Power Head	N4240A-5	18851-G1
Waveguide Power Head	K4240C-5	18868-G2
Waveguide Power Head	A4240C-5	18868-G1
Carrying Case	-	9407-G1
AC Line Cord	-	13749-P1

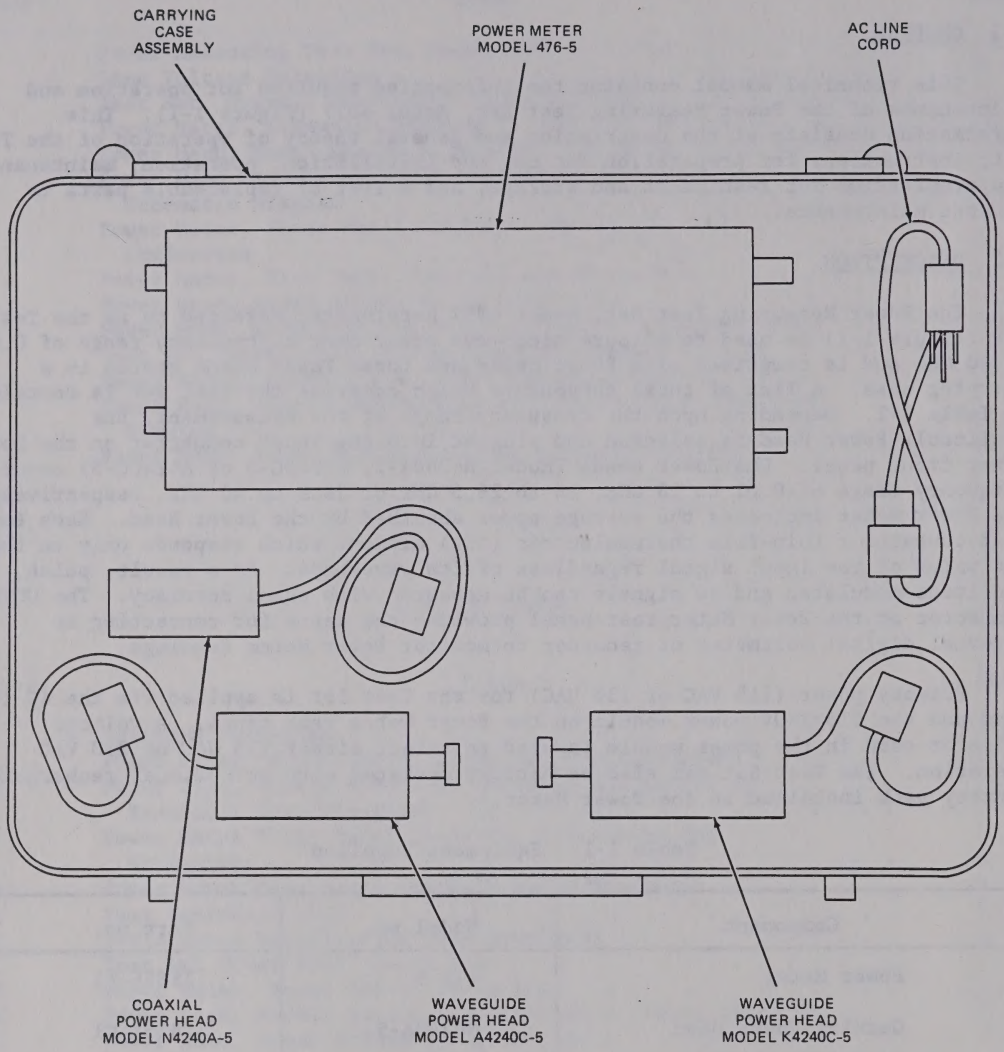


Figure 1-1. Power Measuring Test Set, Model 4037

1-3 TECHNICAL SPECIFICATIONS.

Table 1-2 lists the technical specifications for Power Meter Model 476-5. The technical specifications for Power Head Models N4240A-5, K4240C-5 and A4240C-5 are located in Table 1-3.

Table 1-2. Power Meter, Model 476-5, Technical Specifications

Characteristic	Specification
Power measurement ranges	Seven (7) milliwatt/dBm ranges, selectable by front panel control
Milliwatt/dBm ranges (full scale)	0.01/-20, 0.03/-15, 0.1/-10, 0.3/-5, 1.0/0, 3.0/+5 and 10.0/+10 mW/dBm
Accuracy	±1% of full scale from 0°C to +55°C (all ranges)
Noise and drift	Less than 1.5% peak on most sensitive range; proportionately less on less sensitive ranges
Zero set	Manually adjustable to zero on all range settings
Power head calibration factor compensator	Continuously variable between 86% and 100% by front panel control
DVM/recorder output	Rear-mounted connector provides output proportional to indicated power; minimum load resistance of 100K
Input power	115 VAC/230 VAC ±10%, 48 to 1000 Hz, 5 watts
Input connector	Front-panel mounted
Meter type	4.5-in. mirror scale
Dimensions (nominal):	
Height	6.1 in. (155 mm)
Width	5.1 in. (130 mm)
Depth	11.3 in. (279 mm)
Weight (approx.)	6 lbs (2.7 Kg)

Table 1-3. Power Head, Models N4240A-5, K4240C-5 and A4240C-5, Technical Specifications

Characteristic	Specification		
	N4240A-5	K4240C-5	A4240C-5
Input connector type	N-Male	UG-595/U	UG-599/U
Transmission line	Coaxial	RG-53/U	RG-96/U
Frequency range (GHz)	0.01 to 18.0	18.0 to 26.5	26.5 to 40.0
Max. average power	10 mW (+10 dBm)	10 mW (+10 dBm)	10 mW (+10 dBm)
CW overload rating	300%	300%	300%
Max. pulse energy at +25°C (W-usec)	5 (with PRF of 1 KHz or less)	5	5
Max. pulse power at +25°C (W)	200	5	5
Max. pulse duration at max. pulse power and 25°C	25 nsec	1 usec	1 usec
Max. DC voltage	10V	-	-
Temperature range:			
Storage	-54°C to +85°C	-54°C to +125°C	-54°C to +125°C
Operating	-54°C to +85°C	-54°C to +85°C	-54°C to +85°C
Element temperature sensitivity	0.1%/°C	0.1%/°C	0.1%/°C
Max. VSWR	1.35* to 10 GHz; 1.60 from 10 GHz to 18 GHz	1.50	1.65
Diameter (nominal)	1.28 in. (33 mm)	2.12 in. (54 mm)	2.12 in. (54 mm)

Table 1-3. Power Head, Models N4240A-5, K4240C-5 and A4240C-5, Technical Specifications - Continued

Characteristic	Specification		
	N4240A-5	K4240C-5	A4240C-5
Length	2.95 in.** (75 mm)	3.73 in.*** (95 mm)	3.73 in.*** (95 mm)
Weight (approx.)	6.3 oz. (179 g)	32 oz. (907 g)	32 oz. (907 g)

* Except in the range from 0.010 to 0.015 GHz where VSWR may rise to 1.50.

** Maximum, including rf connector, but excluding cable and multi-pin connector.

*** Maximum, excluding rf connector, cable and multi-pin connector.

1-4 SAFETY PRECAUTIONS.

The Test Set is operated from a 115 VAC or 230 VAC primary power source applied to the Power Meter via the AC line cord. Make sure that the line cord is disconnected from the power source before opening the Power Meter for servicing. If it is necessary to work on an energized unit, make sure that someone capable of rendering aid is present. Personnel working with or near high voltages should be familiar with modern methods of resuscitation. Such information may be obtained from the Bureau of Medicine and Surgery.

SECTION II

PREPARATION FOR USE AND INSTALLATION

2-1 GENERAL.

This section contains the preparation-for-use procedures for the Test Set. Instructions are provided for unpacking, inspection, and initial setup and checkout. Operating precautions to be observed during operation of the Test Set are also included.

2-2 UNPACKING AND INSPECTION.

The Test Set is shipped with its major assemblies stored in a carrying case. Unpack and inspect the Test Set assemblies as follows:

a. Remove the Test Set from its shipping container. Save and store packing material for reuse for shipment or storage purposes.

b. Loosen the two latches on the carrying case and remove the following assemblies:

(1) Power Meter Model 476-5

(2) Power Heads Models N4240A-5, K4240C-5 and A4240C-5

(3) AC line cord

c. Visually inspect the Test Set assemblies for the following:

(1) Signs of damage or loose hardware

(2) Damaged or loose switches, knobs and connectors

(3) Frayed or damaged cables.

d. Report any damaged or missing items.

2-3 INITIAL SETUP AND CHECKOUT.

To prepare the Test Set for use, refer to paragraph 4-2 (Operating Controls, Indicators and Connectors) and proceed as follows:

a. Determine the AC line voltage to be used (115 VAC or 230 VAC). Verify that the power module located on the rear panel of the Power Meter is set for the required line voltage. This is indicated by the appearance of an indicator pin to the right of the required line voltage imprinted on the power module (Figure 2-1). The 120V and 240V positions are used to select

115 VAC and 230 VAC, respectively. If it is necessary to change the selected line voltage, proceed as follows:

(1) Remove the module cover and fuse block (Figure 2-1) using a small blade screwdriver or similar tool.

(2) Pull the voltage selector card straight out of the housing.

(3) Orient the indicator pin to point up when the desired voltage is readable at the bottom of the voltage selector card. Note that when the indicator pin is fixed, successive voltages are selected by rotating the voltage selector card 90 degrees clockwise.

(4) Install the voltage selector card, fuse block and cover.

(5) Verify that the indicator pin appears to the right of the selected voltage.

b. Set the BAT CHK-ON-OFF switch on the front panel of the Power Meter to OFF.

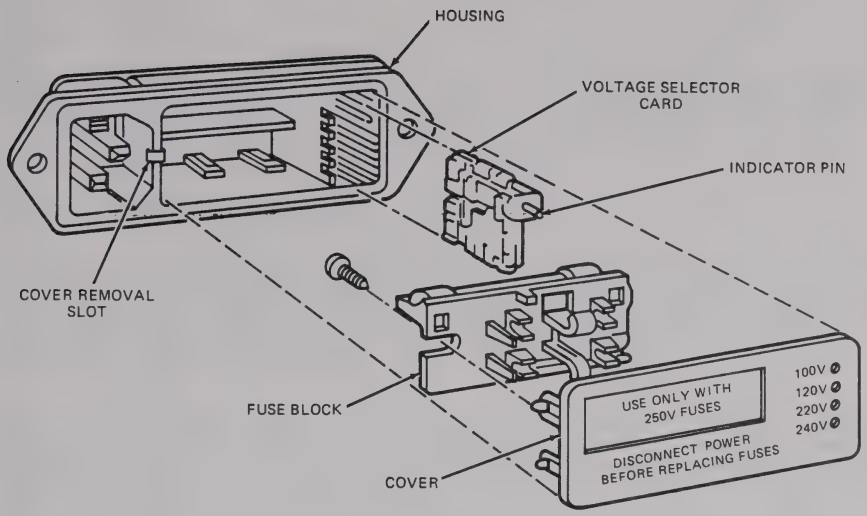
c. Connect the AC line cord to the power module and the 115 VAC or 230 VAC primary power source.

d. Set the BAT CHK-ON-OFF switch to ON. Allow a 15-minute warmup period.

e. Perform the tests described in paragraph 5-6 to verify Test Set operation. Observe the operating precautions decribed in paragraph 2-4 when operating the Test Set.

2-4 OPERATING PRECAUTIONS.

With the following exceptions, no special precautions need be observed when installing or using the Power Meter and Power Heads other than the normal good practice associated with the use of accurate measurement instruments and microwave components. It is suggested that a warm-up period of about 15 minutes elapse to allow circuit stabilization. The connectors of the Power Heads should be handled with care to avoid scratching or marring the surfaces and connecting parts. Power ratings of the Power Heads should not be exceeded because permanent damage to the tft element may result. Although power ratings are conservatively applied, the margin of safety should not be deliberately narrowed.



VOLTAGE SELECTOR CARD ORIENTATION

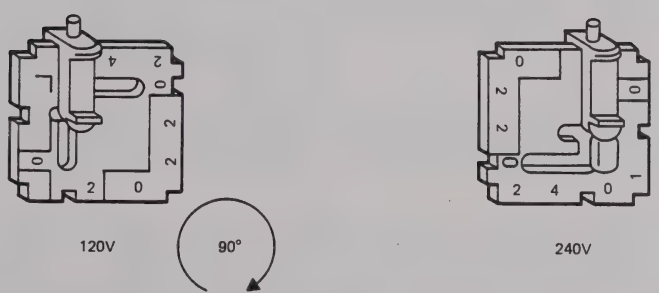


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Figure 2-1. Line Voltage Selection

SECTION III

GENERAL THEORY OF OPERATION

3-1 GENERAL.

This section contains the general theory of operation of the Test Set. An overall functional description of the Test Set is provided on a block diagram level. Circuit descriptions for the Power Meter and a typical Power Head, supported by schematic diagrams, are also provided.

3-2 OVERALL FUNCTIONAL DESCRIPTION. (Figure 3-1)

The Test Set consists of Power Meter Model 476-5 used in conjunction with three Power Heads, Models N4240A-5, K4240C-5 and A4240C-5, to measure microwave power in the frequency range of 0.01 to 40 GHz. The Power Meter operates in the same manner with each of the Power Heads to provide power measurements within the frequency range of the Power Head in use.

The Power Meter is a chopper-stabilized DC amplifier featuring very low noise, high gain, and high gain-stability. A self-contained analog meter M1 indicates measured power. The DC input signal from the Power Head is applied to the input of the low noise amplifier consisting of U1, U2, and U3. Stages U2 and U3 provide the necessary gain for the low-level DC signal from the Power Head. Stage U1 is a low-drift, chopper-stabilized amplifier that measures the offset drift at the input and provides a signal to U2 that corrects for drift. Gain control of the amplifier is provided by resistors R12 through R16. The output DC signal from the low noise amplifier is returned to calibration control potentiometer R1 in the Power Head. This potentiometer is used to adjust the Power Head sensitivity to match the gain of the amplifier.

The output from the calibration control potentiometer is applied to the calibration factor amplifier U4A. CAL FACTOR control R18 on the front panel provides continuous control for calibration factors from 86% to 100%. This control adjusts the gain of the amplifier stage.

The output from the calibration factor amplifier is applied to the meter RANGE switch S1 and to output amplifier U4B. The output amplifier provides additional gain to provide a full-scale reading on meter M1 when RANGE switch S1 is set to each of the "3" scales.

The power supply consisting of a power transformer, rectifier network, and $\pm$7.12-volt regulator U8, U9 provides $\pm$7.12 VDC required for operation of the Power Meter. In addition, it provides the means for recharging the optional battery pack BT1 that can be installed in the Power Meter.

3-3 POWER METER CIRCUIT DESCRIPTION. (Figure 3-2)

3-3.1 Low Noise Amplifier. The low noise amplifier circuit consists of amplifiers U1, U2 and U3. The low-level DC signal from the Power Head is applied to input pin 3 of U2. Amplifier U2 is a low-noise, high-gain amplifier. Additional gain is

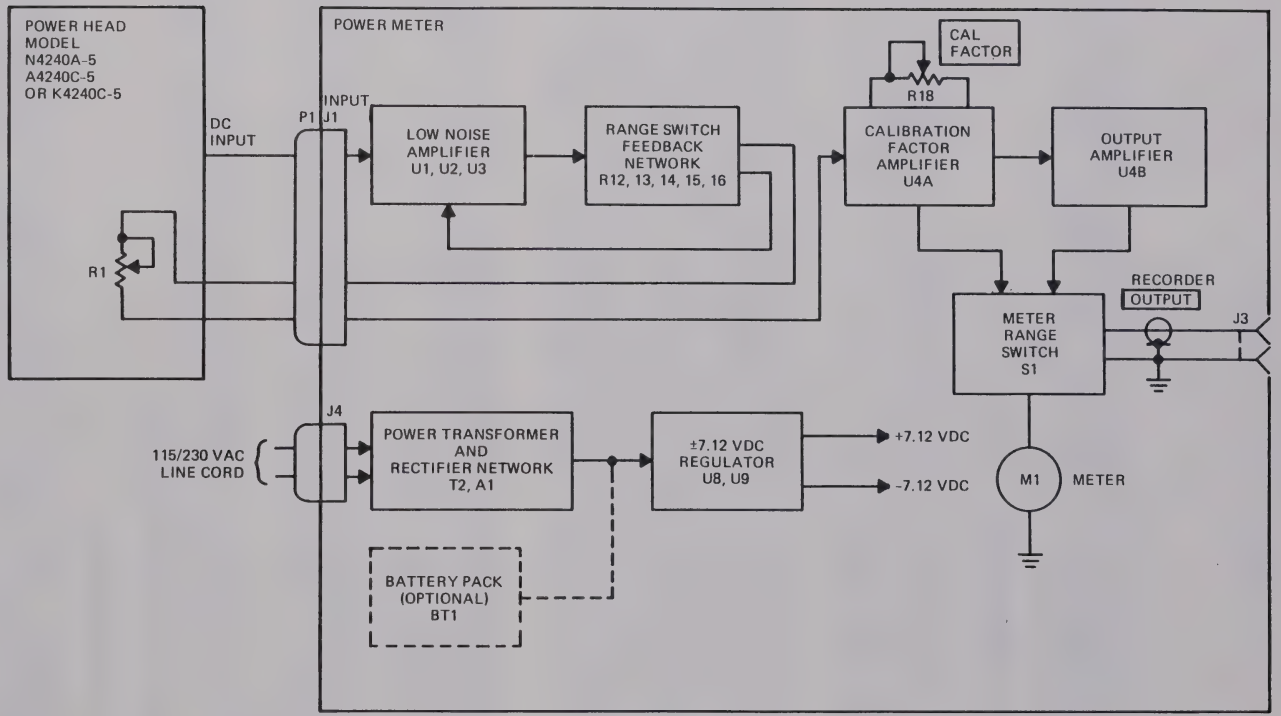

Figure 3-1. Test Set, Overall Functional Block Diagram

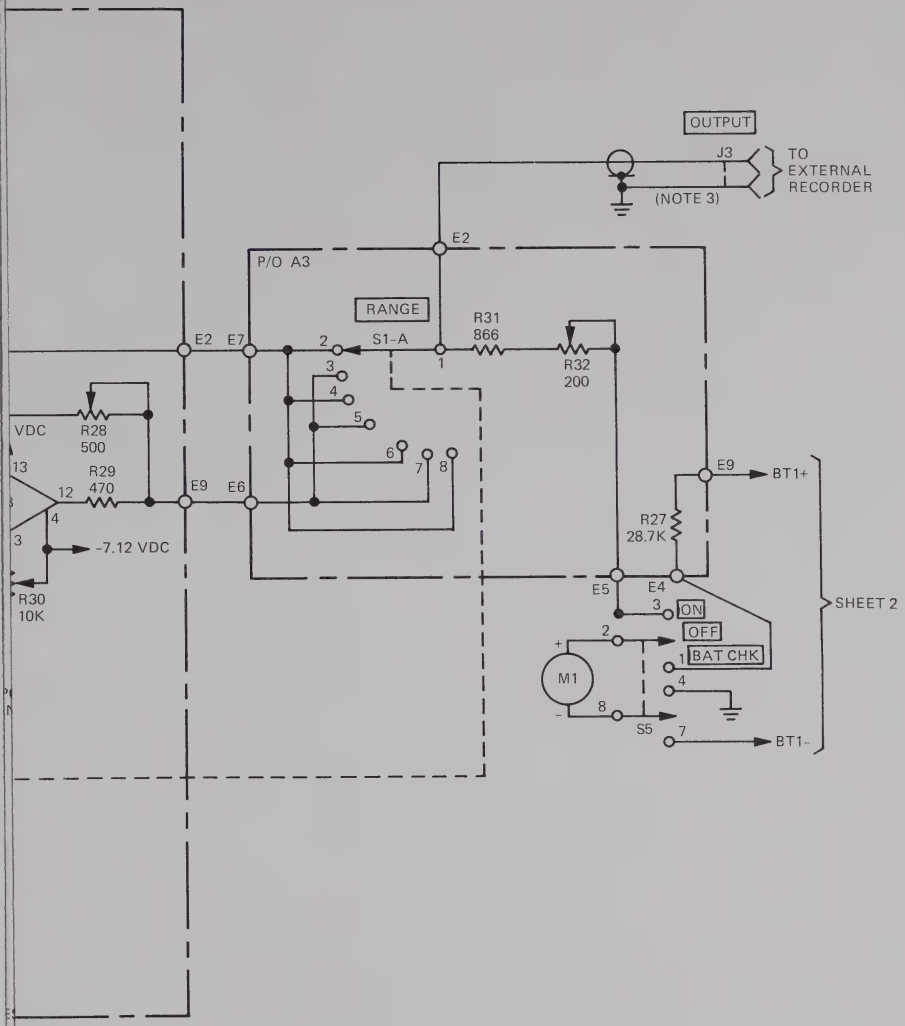

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Figure 3-2. Power Meter, Schematic Diagram (Sheet 1 of 2)

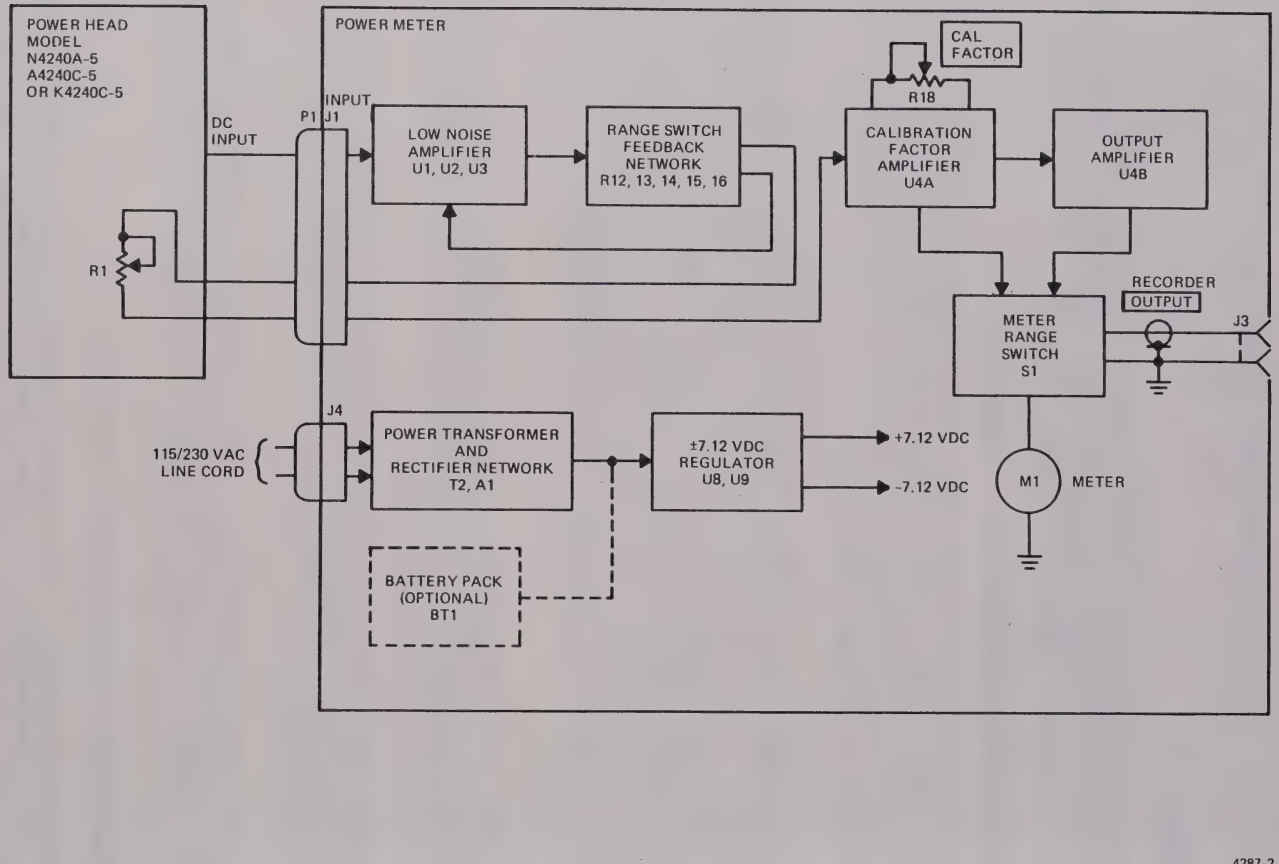
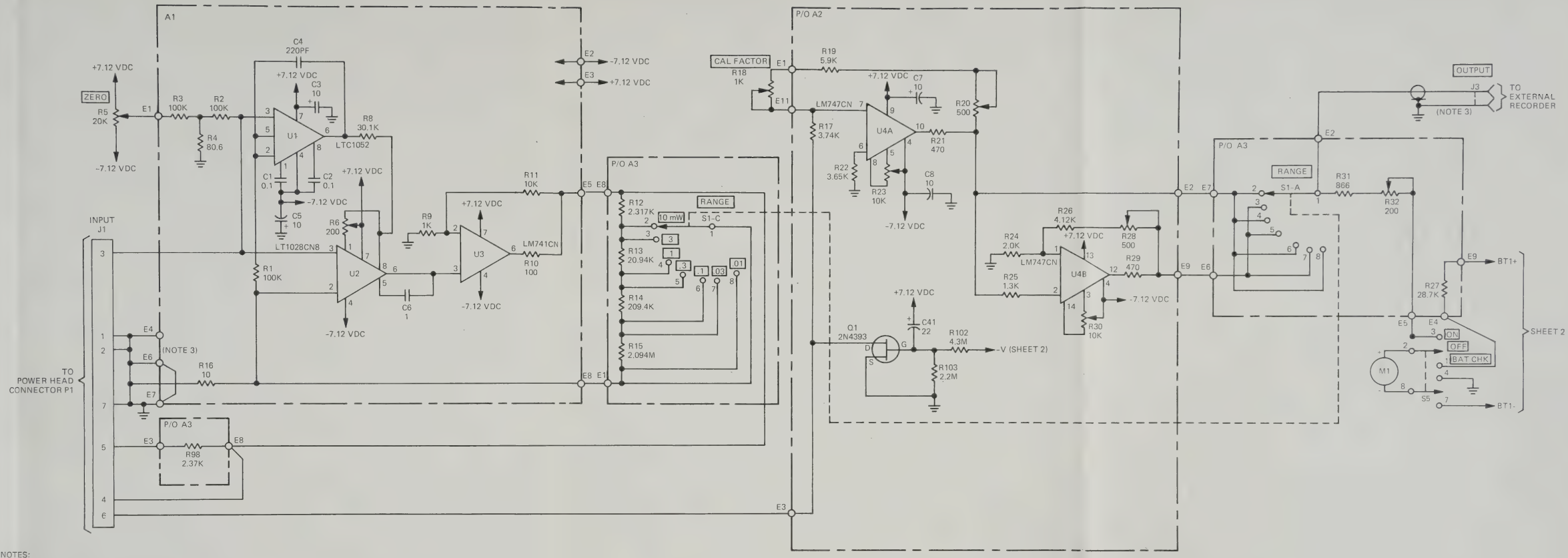


Figure 3-1. Test Set, Overall Functional Block Diagram



NOTES:
1. UNLESS OTHERWISE SPECIFIED:
   ALL RESISTANCE VALUES ARE IN OHMS.
   ALL CAPACITANCE VALUES ARE IN MICROFARADS.
2. PIN LOCATION FOR CONNECTOR J1 IS SHOWN BELOW.

3. CONNECTOR J3 SHIELD WIRED TO TERMINAL E6 ON BOARD A1 (BLACK LEAD).

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Figure 3-2. Power Meter, Schematic Diagram (Sheet 1 of 2)

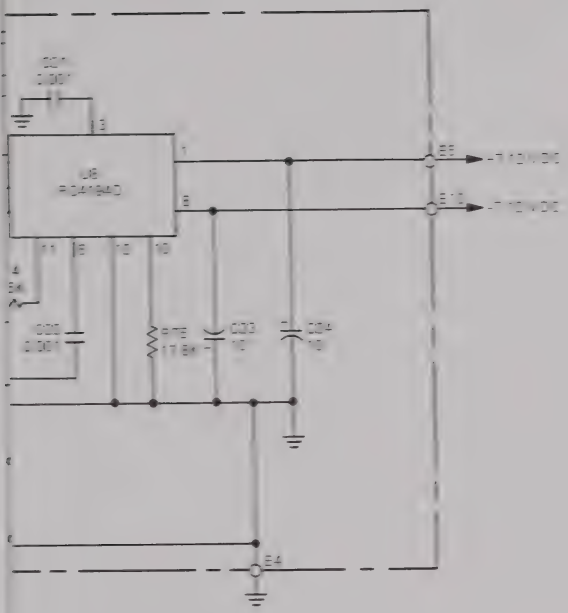

Figure 3-2. Power Meter, Schematic Diagram (Sheet 2 of 2)

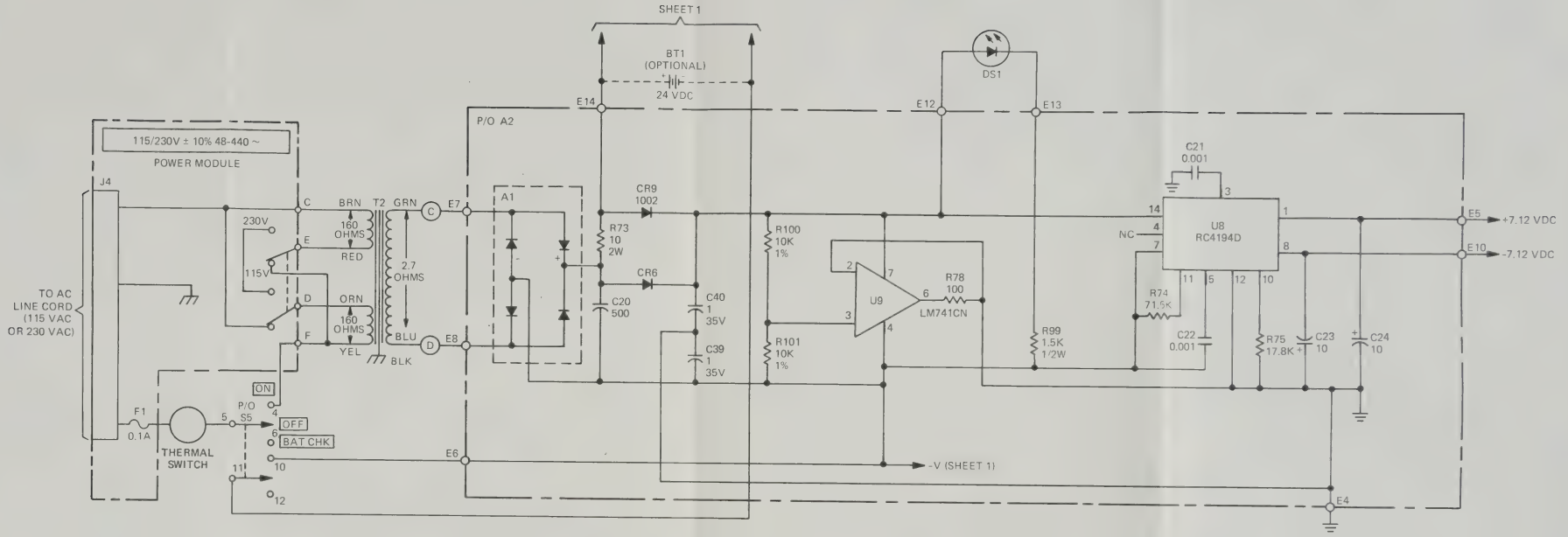

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Figure 3-2. Power Meter, Schematic Diagram (Sheet 2 of 2)

provided by U3. Potentiometer R6 is the offset adjustment for U2. The offset voltage between inputs 2 and 3 of U2 is monitored by chopper-stabilized amplifier U1, and a correction signal is injected at pin 8 of U2 to correct for any circuit drift. The net result of this arrangement is that the low-noise characteristics of U2 are combined with the low-drift characteristics of U1.

The gain of the low noise amplifier is determined by the feedback network consisting of resistors R12 through R16. The gain is determined by the ratio of R12, R13, R14, or R15 to R16. As RANGE switch S1 on the front panel is rotated, resistor R12 adds to R13, then to R14, and then again to R15. This results in decade gain changes corresponding to the "10" scales of the Power Meter. The nominal output of the low noise amplifier is -1 VDC.

3-3.2 Calibration Factor Amplifier. Correction for individual Power Head sensitivity is accomplished by setting the calibration potentiometer in the Power Head. This potentiometer adjusts the gain of the calibration factor amplifier U4A. The gain and offset of this amplifier are adjusted using R20 and R23, respectively. CAL FACTOR control R18 on the front panel adjusts the gain of this amplifier to correct for the calibration factor of the Power Head. It has a range of 86% to 100%. The output of this amplifier is used to drive meter M1 and the recorder output on all of the "10" scales.

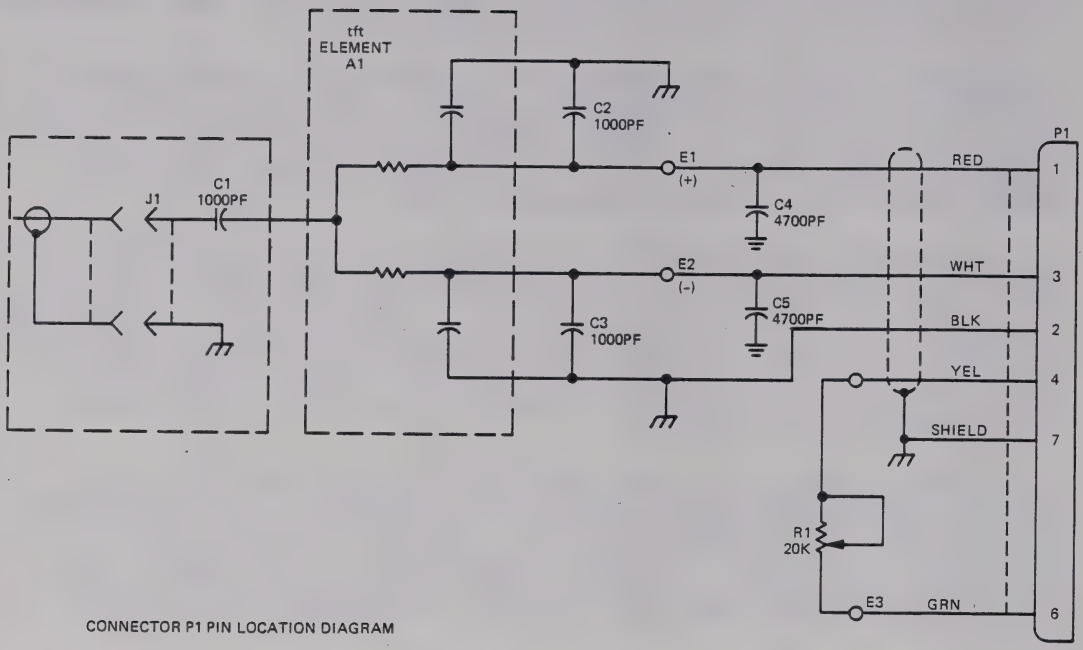
3-3.3 Output Amplifier. The output amplifier U4B gets its input from the calibration factor amplifier and adds gain that converts the 0.3 VDC output from the calibration factor amplifier to a 1 VDC output when the RANGE switch is on a "3" scale. Potentiometers R28 and R30 provide for gain calibration and offset adjustments, respectively. The output voltage on the arm of the RANGE switch is applied to the recorder output and to meter M1. Potentiometer R32 is used to calibrate M1.

3-3.4 Power Supply. The power supply consists of power transformer T2, full-wave rectifier network A1, voltage regulator U8 and amplifier U9. The output voltage from full-wave rectifier A1 is applied to amplifier U9, which derives a ground reference from the Power Meter. This establishes equal positive and negative voltages that are applied to pins 7 and 14 of voltage regulator U8, at which point the voltages are converted to $\pm$7.12 VDC operating voltages for the Power Meter circuits.

3-4 POWER HEAD CIRCUIT DESCRIPTION. (Figures 3-3 and 3-4)

Power Head Models N4240A-5, K4240C-5 and A4240C-5 are the power measuring input devices for Power Meter Model 476-5. The operating frequency ranges for these Power Heads are 0.01 to 18 GHz for Model N4240A-5, 18 to 26.5 GHz for Model K4240C-5, and 26.5 to 40 GHz for Model A4240C-5. The following description is applicable for all three Power Heads since their operating principles are the same. For schematic diagram information, refer to Figure 3-3 for Model N4240A-5 and Figure 3-4 for Models K4240C-5 and A4240C-5.

The thin-film thermoelectric (tft) Power Head contains a thin-film metallic load (tft element A1) which serves as a well-matched termination to absorb the RF power to be measured. The load consists of bismuth and antimony sections which are vacuum deposited on a thin dielectric substrate in a geometric configuration that



CONNECTOR P1 PIN LOCATION DIAGRAM

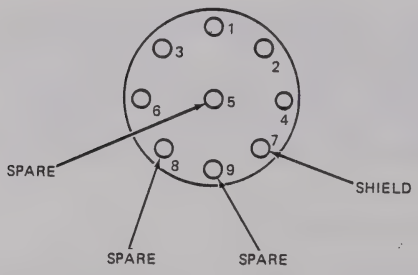


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Figure 3-3. Power Head, Model N4240A-5, Schematic Diagram

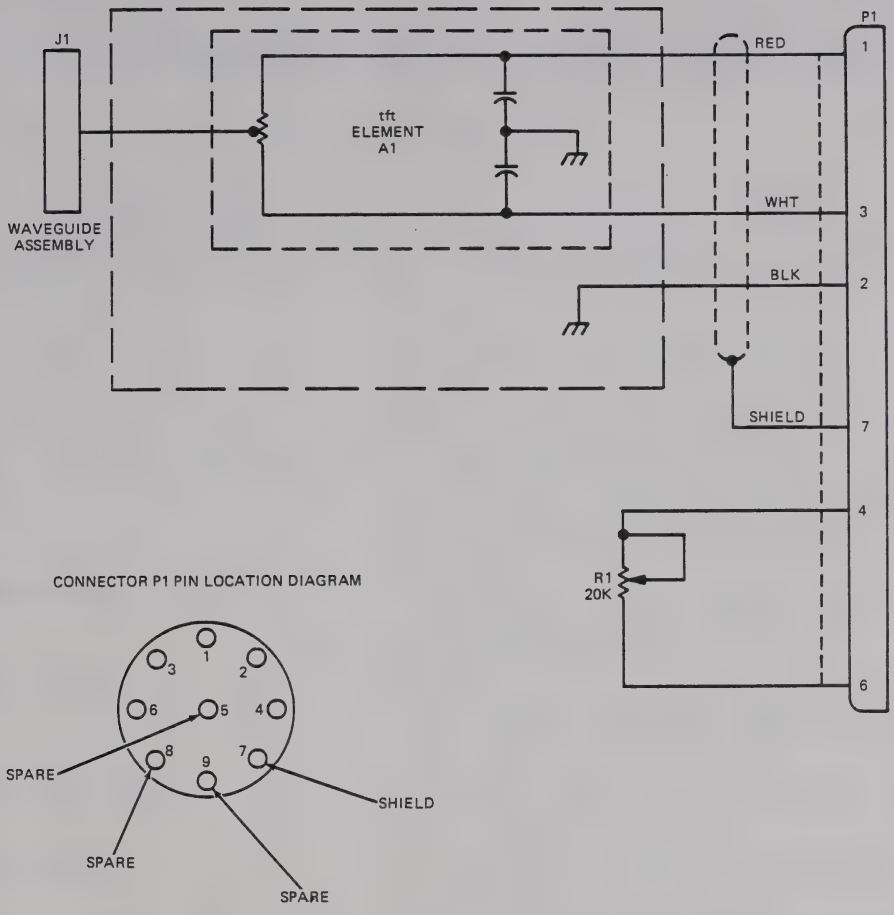

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Figure 3-4. Power Head, Models K4240C-5 and A4240C-5, Schematic Diagram

produces a number of thermoelectric junctions. Some of the junctions are thermally sinked to the transmission line while the remaining junctions are located in the air space between the lines. The absorbed RF power raises the temperature of these latter junctions relative to the sinked junctions. As a result, a thermoelectric EMF is generated proportional to the temperature rise. Because the temperature differential between the junctions is kept small, the Power Head acts as a true square-law (rms) device producing a DC output voltage directly proportional to the absorbed power. Potentiometer R1 is a calibration control used to adjust the Power Head sensitivity to match the gain of the external Power Meter circuits.

SECTION IV

OPERATING INSTRUCTIONS

4-1 GENERAL.

This section contains the instructions for operating the Power Meter. Descriptions of the operating controls, indicators and connectors are also provided.

4-2 OPERATING CONTROLS, INDICATORS AND CONNECTORS.

All operating controls, indicators and connectors for the Test Set are located on the front and rear panels of the Power Meter. Figure 4-1 and Table 4-1 illustrate and describe the controls, indicators and connectors on the front panel. The rear panel controls and connectors are illustrated and described in Figure 4-2 and Table 4-2.

Table 4-1. Power Meter Front Panel Controls, Indicators and Connectors

Item	Function
Meter	Indicates power readings in milliwatts (mW) and dBm over ranges determined by the RANGE (mW dBm) switch setting.
RANGE (mW dBm) switch	A seven-position rotary switch that permits selection of the desired power measurement range.
CAL FACTOR control	Permits compensation for the calibration factor of the Power Head in use within the range of 86% to 100%.
Input connector	Used to connect the Power Head to the Power Meter.
ZERO control	Used to electrically zero the Power Meter.
BAT CHK-ON-OFF switch	A three-position toggle switch used to energize the Power Meter using either AC line power or optional battery power. In the BAT CHK position, permits the battery condition to be checked on the meter.
Power indicator	Lights to indicate that power is applied to the Power Meter.

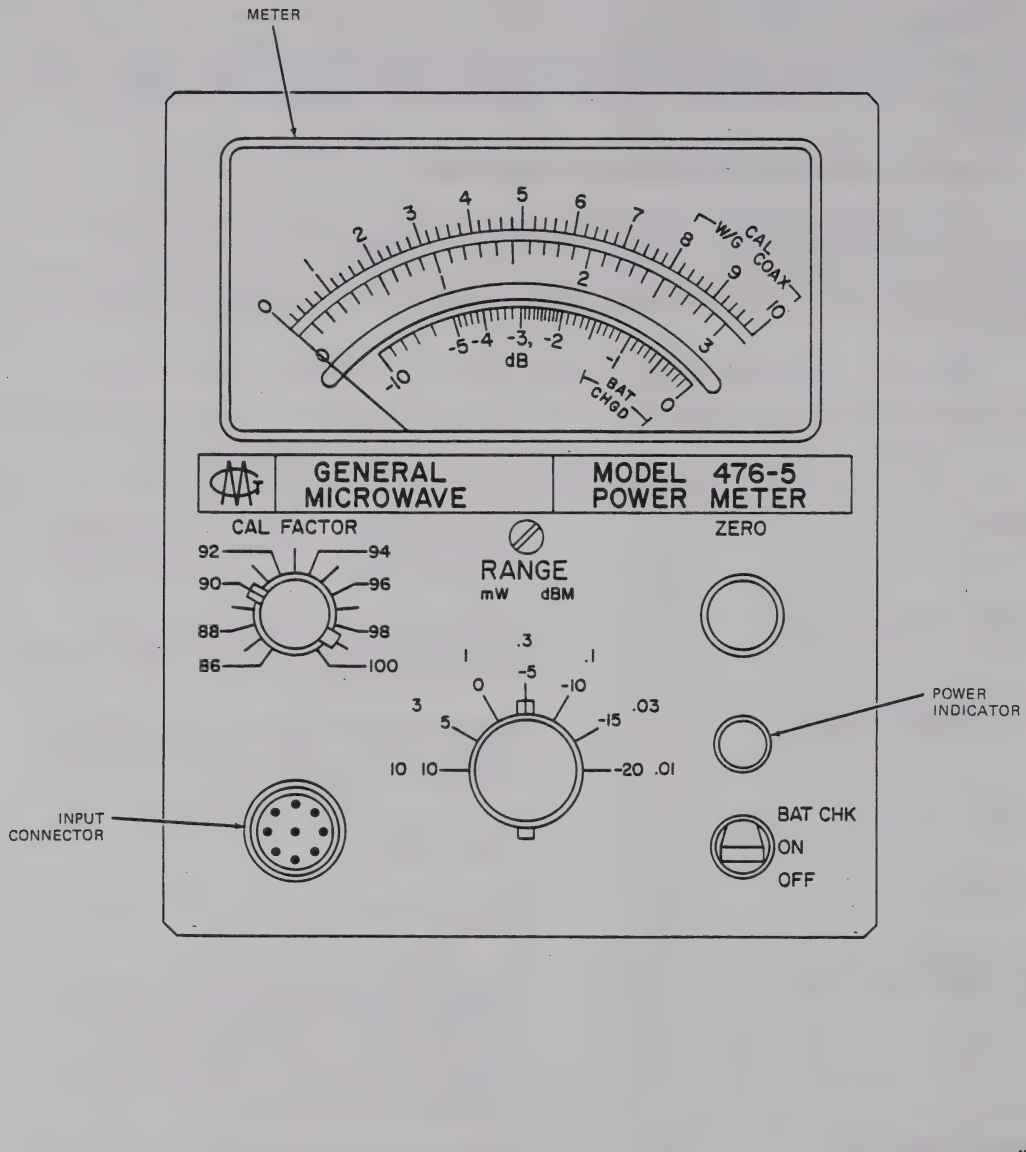

Figure 4-1. Power Meter, Front Panel Controls, Connectors and Indicators

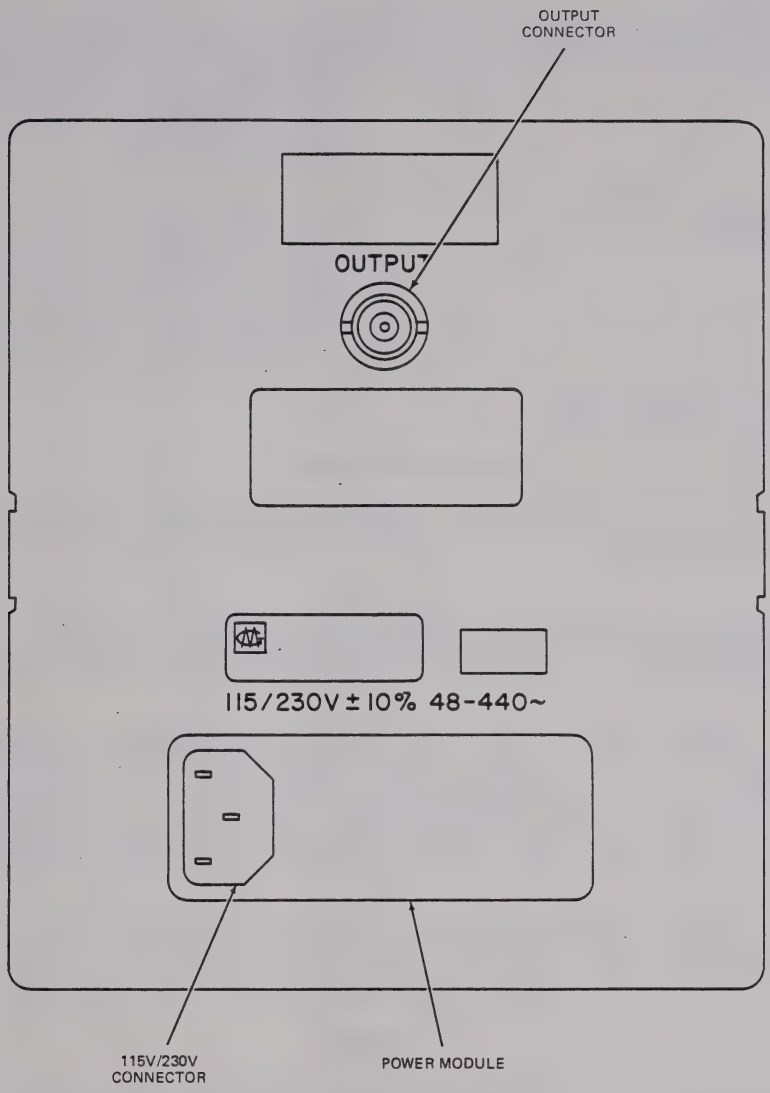

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Figure 4-2. Power Meter, Rear Panel Controls and Connectors

Table 4-2. Power Meter Rear Panel Controls and Connectors

Item	Function
OUTPUT connector	Provides the means for connecting a calibrated analog voltage, proportional to the measured RF power, to an external digital multimeter or recorder for monitoring purposes.
115/230V ± 10% 48-440 ~ power module	Provides the means for connecting 115 VAC or 230 VAC primary power to the Power Meter. A voltage selector card located in the power module permits selection of either 115 VAC or 230 VAC primary power for application to the Power Meter.

4-3 OPERATING INSTRUCTIONS.

To operate the Test Set, proceed as follows:

a. If it is desired to use a recorder to obtain a plot of power output versus time, connect the recorder to the OUTPUT connector on the rear panel of the Power Meter.

b. If AC line power is to be used, refer to paragraph 2-3 and set the power module on the Power Meter rear panel for 115 VAC or 230 VAC as required. Connect the Power Meter to the AC power source, and set the BAT CHK-ON-OFF switch to ON.

c. If optional battery power is to be used, momentarily set the BAT CHK-ON-OFF switch to BAT CHK and verify that the front panel meter indicates in the BAT CHGD region. The Power Meter can be operated about 12 hours on a fully charged battery. The charging cycle is about 16 hours for complete charging. To charge the battery, connect the Power Meter to an AC line power source and set the BAT CHK-ON-OFF switch to ON.

d. Determine the frequency range of the power to be measured. Select the appropriate Power Head that covers this frequency and connect it to the input connector located on the front panel of the Power Meter. At this point, do not connect the Power Head to the source of RF power.

CAUTION

To avoid damage to the Power Head, use an appropriate attenuator or coupler to reduce the power level to be measured to a safe value if the power level could exceed the power rating of the Power Head in use.

e. From the operating RF frequency, determine the calibration factor from the graph mounted on the Power Head and adjust the CAL FACTOR control on the Power Meter to the value indicated.

f. In the absence of RF power, zero the Power Meter on the most sensitive range using the ZERO control.

g. Connect the Power Head to the source of RF power to be measured, adjust the RANGE switch on the Power Meter for an on-scale reading, and read the power directly on the meter. The power range at which the RANGE switch is set determines the meter scale to be used.

SECTION V

MAINTENANCE INSTRUCTIONS

5-1 GENERAL.

This section contains the information necessary for maintenance of the Test Set. Instructions are provided for cleaning, inspection, troubleshooting, and repair or replacement of defective components. Performance verification test and calibration procedures are provided to check and adjust the Test Set for proper operation on a periodic basis and after a corrective maintenance action has been taken. During the performance of the maintenance procedures, reference should be made, as necessary, to the schematic diagrams contained in Section III and the parts location diagrams contained in Section VII.

5-2 SPECIAL TOOLS AND TEST EQUIPMENT.

The only special tool required is the U-jig which is supplied with the replacement tft element kit for Power Head Model N4240A-5. This tool is used during disassembly of the Power Head to replace the tft element. The test equipment required for testing, troubleshooting and calibration of the Test Set are listed in Table 5-1. Equivalent substitutes may be used if necessary.

Table 5-1. Test Equipment List

Item	Manufacturer	Model or Part no.
Calibrator	General Microwave	308
Digital Multimeter	Fluke	8600A
Variable Autotransformer	Superior 116	
Calibrated Signal Source	Any	See paragraph 5-6.2 for specifications

5-3 CLEANING AND LUBRICATION.

CAUTION

Avoid the use of chemical cleaning agents which might damage the plastics used in these instruments. Avoid chemicals which contain benzene, toluene, xylene, acetone or similar solvents. Recommended cleaning agent is isopropyl alcohol.

5-3.1 Cleaning. There are no special cleaning requirements for the Test Set. Wipe the external surfaces of the Power Meter and Power Heads, and all switches, knobs, connectors and indicators, with a lint-free cloth moistened with isopropyl alcohol or an equivalent substitute.

5-3.2 Lubrication. There are no lubrication requirements for the Test Set.

5-4 INSPECTION.

Visually inspect the Test Set assemblies for the following:

a. Signs of damage or loose hardware

b. Damaged or loose switches, knobs and connectors

c. Frayed or damaged cables.

5-5 TROUBLESHOOTING.

5-5.1 General. Troubleshooting procedures for the Test Set consist of the procedures outlined below and the test and adjustment procedures described in paragraphs 5-5.2 and 5-5.3. Apparent malfunctions can result from incorrect control settings or faulty inputs from a Power Meter. If a malfunction is indicated, be sure to perform the following checks before proceeding with extensive troubleshooting:

a. Ensure that the voltage selector card contained in the power module on the Power Meter rear panel is properly set for the AC line voltage being applied.

b. Ensure that the BAT CHK-ON-OFF switch on the front panel is set to ON.

c. Check line cord for proper connection.

d. Check all Power Meter controls for proper setting.

e. Ensure that the power input being measured does not exceed the full-scale setting of the RANGE switch.

f. Check associated equipment. Ensure that the microwave power circuit is operative and that power is present at the Power Head.

g. Connect the Power Head to the Power Meter and, with no RF signal applied, zero the Power Meter as follows:

(1) Set the RANGE switch to the .01 mW (-20 dBm) position.

(2) Adjust the ZERO control for a 0 indication on the meter.

h. If the Power Meter does not zero properly, the malfunction probably exists in the Power Head. Substitute another Power Head and check for zeroing. If the second Power Head zeroes properly, the malfunction is in the first Power Head. If the Power Meter zeroes properly but does not respond with power present at the Power Head, the probable cause is again a defective Power Head. Repeat the substitution test above for verification. If the Power Meter does not zero with any Power Head, the malfunction is probably in the Power Meter.

i. When a malfunction has been isolated to the Power Meter or a Power Head, perform the applicable procedures given in paragraph 5-5.2 or 5-5.3, respectively, to locate the faulty component.

5-5.2 Power Meter Tests and Adjustments. The procedures for testing and adjusting the Power Meter to locate and correct circuit malfunctions are presented in the following paragraphs. These procedures should also be performed in their entirety to completely check and adjust the Power Meter after a repair has been effected. The tests may be performed in any sequence that is convenient; however, the preliminary procedures in paragraph 5-5.2.1 must be performed before initiating any tests. The following test equipment is required for the Power Meter tests:

a. Calibrator, General Microwave Model 308

b. Digital Multimeter, Fluke Model 8600A

c. Variable Autotransformer, Superior Model 116 (115 VAC power tests only)

WARNING

Voltages dangerous to life are present in the Power Meter when the AC line cord is connected to a primary power source. Make certain that power is disconnected before opening the Power Meter. Observe all safety precautions while working on energized equipment.

5-5.2.1 Preliminary Procedures. Perform the following procedures before initiating any tests:

CAUTION

To prevent damage to transistors or integrated circuits, use a digital multimeter to make resistance checks. Do not make resistance checks with an analog-type ohmmeter using the low-ohms range.

a. Before applying AC power, set the BAT CHK-ON-OFF switch to OFF and perform continuity tests, using a digital multimeter, to ensure that neither side of the line cord is connected to the chassis.

b. Set the power module located on the rear panel for the proper line voltage (115 VAC or 230 VAC) as described in paragraph 2-3.

c. For units operating with 115 VAC line voltage, connect the variable autotransformer to a source of 115 VAC, 60 Hz power. Adjust the autotransformer to 115 VAC. The autotransformer is not used in tests of units operating with 230 VAC line voltage.

d. Mechanically zero the front panel meter if necessary.

e. Connect the calibrator to the input connector on the front panel and depress the PWR and SCALE pushbuttons. The ZERO pushbutton should be in the OFF position. All tests must be conducted with the SCALE pushbutton depressed (+10 dB position).

f. Set the BAT CHK-ON-OFF switch to ON. Allow a 15-minute warm-up period before proceeding with testing.

5-5.2.2 Power Supply Tests. To check the power supply circuits, proceed as follows:

NOTE

For units operating with 115 VAC line voltage, perform steps a through e. For units operating with 230 VAC line voltage, perform steps b and c only (do not record voltage indications).

a. Adjust the variable autotransformer to 103 VAC.

b. Set the digital multimeter for operation as a DC voltmeter on its 20 VDC range, and connect it between terminal E4 (ground) and terminal E5 (+7.12 VDC) on printed wiring board assembly A2. Verify that the multimeter indicates between +6.76 VDC and +7.83 VDC. Record the indicated voltage.

c. Connect the multimeter between terminal E4 (ground) and terminal E10 (-7.12 VDC) on printed wiring board assembly A2. Verify that the multimeter indicates between -6.76 VDC and -7.83 VDC. Record the indicated voltage.

d. Adjust the autotransformer to 127 VAC, and repeat steps b and c. Verify that the two indicated voltages do not differ from those recorded above by more than 25 mV.

e. Readjust the autotransformer to 115 VAC.

5-5.2.3 DC Zero and Gain Adjustments. The DC zero and gain adjustment controls are located on printed wiring boards inside the Power Meter. To gain access to these controls, open the Power Meter as described in paragraph 5-8.2.1. Refer to

the parts location diagrams in Section VII to locate these controls. To perform the DC zero and gain adjustments, proceed as follows:

WARNING

Voltages dangerous to life are present in the Power Meter when the AC line cord is connected to a primary power source. Make certain that power is disconnected before opening the Power Meter. Observe all safety precautions while working on energized equipment.

a. Adjust the CAL FACTOR control on the front panel fully clock-wise.

b. Set the RANGE switch to the 0.01 mW (-20 dBm) position.

c. Connect the digital multimeter to the OUTPUT connector on the rear panel.

d. Set the multimeter to read DC voltage on its 2 V range.

e. Center the ZERO control by turning it five (5) turns from either extreme and adjust R6 on printed wiring board assembly A1 for a nominal zero volt indication on the multimeter.

f. Set the RANGE switch to the 10 mW (10 dBm) position.

g. Adjust R23 on printed wiring board assembly A2 for a reading of 0 V ± 1 mV on the multimeter.

h. Set the RANGE switch to the 3 mW (5 dBm) position.

i. Adjust R30 on printed wiring board assembly A2 for a reading of 0 V ± 1 mV on the multimeter.

j. Set the RANGE switch to the 10 mW (10 dBm) position.

k. Set the POWER RANGE control on the calibrator to 10 mW.

l. With the ZERO button on the calibrator set to OFF (button out), verify that the multimeter indicates 0 V ± 1 mV; if not, repeat step g.

m. Depress the ZERO button on the calibrator (ON position).

n. Adjust R20 on printed wiring board assembly A2 for a multimeter reading of 1.000 V ± 1 mV.

o. Set the ZERO button on the calibrator to OFF, and verify again that the multimeter reads 0 V ± 1 mV; if not, repeat steps g and o until the reading in step g is 0 V ± 1 mV and the reading in step o is 1.000 V ± 1 mV.

p. Depress the ZERO button on the calibrator (ON position), and adjust R32 on printed wiring board assembly A3 for a reading of 10 mW on the front panel meter.

q. Set the calibrator POWER RANGE control to 3 mW.

r. Set the RANGE control to the 3 mW (5 dBm) position.

s. Set the ZERO button on the calibrator to OFF (button out). Verify that the multimeter indicates 0 V ± 1 mV; if not, repeat step i.

t. Set the ZERO button on the calibrator to ON, and adjust R28 on printed wiring board A2 for a multimeter reading of 1.000 V ± 1 mV.

5-5.2.4 Range-to-Range Accuracy Test.

NOTE

Before each range-accuracy test, verify that the digital multimeter indicates zero with the calibrator ZERO button in the OFF position; if not, set it to zero using the ZERO control on the front panel.

a. Set the RANGE switch on the front panel to the 10 mW (10 dBm) position.

b. Set the POWER RANGE switch on the calibrator to the 10 mW range, set the ZERO button to ON, and verify that the multimeter indicates 1.000 V ± 5 mV.

c. Repeat steps a and b for each of the other six positions of the RANGE switch. In each case, set the calibrator POWER RANGE switch to the same range as indicated on the RANGE switch.

d. Set the RANGE switch on the front panel and the POWER RANGE switch on the calibrator to their 10 mW positions.

e. Set the CAL FACTOR controls on the front panel to 86%, and verify that the multimeter indicates 1.163 V ± 15 mV.

5-5.3 Power Head Tests. Power Head testing consists of a resistance check of the tft element using a digital multimeter. To check the tft element, proceed as follows:

a. Set digital multimeter to the 2000 ohm scale.

b. Measure resistance between pins 1 and 3 on connector P1. Resistance should be as follows:

Model	Resistance
N4240A-5	200 ± 30 ohms
K4240C-5	260 ± 40 ohms
A4240C-5	260 ± 40 ohms

c. If the reading is not within tolerance, replace the tft element.

5-6 PERFORMANCE VERIFICATION.

5-6.1 General. The test procedures required to verify the performance of the Test Set are presented in the following paragraphs. These procedures must be performed on a periodic basis to ascertain proper equipment operation, and after a repair of the Test Set has been made. It is recommended that these test procedures be performed periodically every twelve (12) months. The procedures involve testing of the Power Meter with each of the Power Heads and should be performed in the sequence presented. The acceptable test standards for each of the test signals applied during the tests are given in Table 5-2.

5-6.2 Test Equipment Required. All tests require a calibrated signal source with the following specifications:

Output frequency range: 10 MHz to 40 GHz

Output power level: -20 dBm to +10 dBm

VSWR: 2:1 max

5-6.3 Standard Instructions. The following standard instructions must be performed where specified during the performance verification tests:

a. The Power Meter must be zeroed electrically before performing any measurement accuracy test in paragraphs 5-6.4, 5-6.5 and 5-6.6. To zero the Power Meter, set the RANGE switch to the -20 dBm position. With no RF signal applied to the Power Head-under-test, adjust the ZERO control for a 0 indication on the meter.

b. For all power measurements, select the Power Meter range that provides the greatest meter deflection without exceeding full scale.

c. For each test frequency, adjust the CAL FACTOR control on the Power Meter to agree with the Calibration Factor-Versus-Frequency graph mounted on the case of the Power Head-under-test.

Table 5-2. Performance Verification Test Standards

Test para (step)	Applied test signal	Test limits
	Power Head Model N4240A-5	
5-6.4 (b)	10 MHz, 1.0 mW	0.788 to 1.212 mW
5-6.4 (c)	1 GHz, 1.0 mW	0.822 to 1.178 mW
5-6.4 (c)	8 GHz, 1.0 mW	0.822 to 1.178 mW
6-6.4 (c)	18 MHz, 1.0 mW	0.822 to 1.178 mW
5-6.4 (d)	8 GHz, 0.01 mW	8.22 to 11.78 uW
5-6.4 (e)	8 GHz, 0.1 mW	82.2 to 117.8 uW
6-6.4 (e)	8 GHz, 10 mW	8.22 to 11.78 mW
	Power Head Model K4240C-5	
5-6.5 (b)	18 GHz, 1.0 mW	0.734 to 1.266 mW
5-6.5 (c)	22 GHz, 1.0 mW	0.734 to 1.266 mW
5-6.5 (c)	26.5 GHz, 1.0 mV	0.734 to 1.266 mW
5-6.5 (d)	18 GHz, 0.01 mW	7.34 to 12.66 uW
5-6.5 (e)	18 GHz, 0.1 mW	73.4 to 112.6 uW
5-6.5 (e)	18 GHz, 10 mW	7.34 to 11.26 mW
	Power Head Model A4240C-5	
5-6.6 (b)	26.5 GHz, 1.0 mW	0.734 to 1.266 mW
5-6.6 (c)	33 GHz, 1.0 mW	0.734 to 1.266 mW
5-6.6 (c)	40 GHz, 1.0 mW	0.734 to 1.266 mW
5-6.6 (d)	26.5 GHz, 0.01 mW	7.34 to 12.66 uW
5-6.6 (e)	26.5 GHz, 0.1 mW	73.4 to 126.6 uW
5-6.6 (e)	26.5 GHz, 10 mW	7.34 to 12.66 mW

5-6.4 Power Head Model N4240A-5. To test Power Head Model N4240A-5 and the Power Meter, proceed as follows:

a. Set the BAT CHK-ON-OFF switch on the Power Meter to OFF. Connect Power Head Model N4240A-5 to the Power Meter input connector. Set the BAT CHK-ON-OFF switch to ON. Allow a 15-minute warmup period before proceeding with the test.

b. Adjust the CAL FACTOR control and zero the Power Meter as described in paragraph 5-6.3. Using the calibrated signal source, apply a 10 MHz CW signal at 1.0 mW (0 dBm) to the Power Head. Verify that the Power Meter indicates within the limits specified in Table 5-2 for the applied test signal.

c. Repeat step b at test frequencies of 1 GHz, 8 GHz and 18 GHz.

d. Adjust the CAL FACTOR control and zero the Power Meter as described in paragraph 5-6.3. Apply an 8 MHz CW signal at 0.01 mW (-20 dBm) to the Power Head. Verify that the Power Meter indicates within the limits specified in Table 5-2 for the applied test signal.

e. Repeat step d at power levels of 0.1 mW (-10 dBm) and 10 mW (10 dBm).

f. Disconnect the Power Head from the Power Meter.

5-6.5 Power Head Model K4240C-5. To test Power Head Model K4240C-5 and the Power Meter, proceed as follows:

a. Set the BAT CHK-ON-OFF switch on the Power Meter to OFF. Connect Power Head Model K4240C-5 to the Power Meter input connector. Set the BAT CHK-ON-OFF switch to ON. Wait for about one minute to allow the units to stabilize.

b. Adjust the CAL FACTOR control and zero the Power Meter as described in paragraph 5-6.3. Using the calibrated signal source, apply an 18 GHz CW signal at 1.0 mW (0 dBm) to the Power Head. Verify that the Power Meter indicates within the limits specified in Table 5-2 for the applied test signal.

c. Repeat step b at test frequencies of 22 GHz and 26.5 GHz.

d. Adjust the CAL FACTOR control and zero the Power Meter as described in paragraph 5-6.3. Apply an 18 GHz CW signal at 0.01 mW (-20 dBm) to the Power Head. Verify that the Power Meter indicates within the limits specified in Table 5-2 for the applied test signal.

e. Repeat step d at power levels of 0.1 mW (-10 dBm) and 10 mW (10 dBm).

f. Disconnect the Power Head from the Power Meter.

5-6.6 Power Head Model A4240C-5. To test Power Head Model A4240C-5 and the Power Meter, proceed as follows:

a. Set the BAT CHK-ON-OFF switch on the Power Meter to OFF. Connect Power Head Model A4240C-5 to the Power Meter input connector. Set the BAT CHK-ON-OFF switch to ON. Wait for about one minute to allow the units to stabilize.

b. Adjust the CAL FACTOR control and zero the Power Meter as described in paragraph 5-6.3. Using the calibrated signal source, apply a 26.5 GHz CW signal at 1.0 mW (0 dBm) to the Power Head. Verify that the Power Meter indicates within the limits specified in Table 5-2 for the applied test signal.

c. Repeat step b at test frequencies of 33 GHz and 40 GHz.

d. Adjust the CAL FACTOR control and zero the Power Meter as described in paragraph 5-6.3. Apply a 26.5 GHz CW signal at 0.01 mW (-20 dBm) to the Power Head. Verify that the Power Meter indicates within the limits specified in Table 5-2 for the applied test signal.

e. Repeat step d at power levels of 0.1 mW (-10 dBm) and 10 mW (10 dBm).

f. Disconnect the Power Head from the Power Meter and secure the test equipment.

5-7 POWER HEAD CALIBRATION.

5-7.1 General. The calibration procedures for Power Head Models N4240A-5, K4240C-5 and A4240C-5 are presented in the following paragraphs. These procedures must be performed on a periodic basis and after a Power Head has been repaired. It is recommended that the Power Heads be calibrated periodically every twelve (12) months.

5-7.2 Test Equipment Required. The Power Head calibration procedures require a calibrated signal source with the following specifications:

Output frequency range:	10 MHz to 40 GHz
Output power level:	-20 dBm to +10 dBm
VSWR:	2:1 max

5-7.3 Power Head Model N4240A-5. The calibration setup for Power Head Model N4240A-5 consists of a calibrated directional coupler, a power head assembly, and Power Meter Model 476-5. To calibrate the Power Head, proceed as follows:

a. Set the BAT CHK-ON-OFF switch on the Power Meter to OFF. Connect Power Head Model N4240A-5 to the Power Meter input connector. Set the BAT CHK-ON-OFF switch to ON. Allow a 15-minute warmup period.

b. Adjust the ZERO control on the Power Meter for a 0 indication on the meter. Turn the CAL FACTOR control to 100%.

c. Connect a digital multimeter to the OUTPUT connector on the Power Meter rear panel. Set the multimeter to the 2 VDC range.

d. Set the RANGE switch on the Power Meter to 1 mW (0 dBm). Using the calibrated signal source, apply a 1.0 GHz signal at 1.0 mW (0 dBm) to the Power Head. Verify that the digital multimeter indicates between 0.970 VDC and 1.020 VDC, and record the reading.

e. If a proper reading is not obtained in step d, adjust potentiometer R1 inside the Power Head for a reading of 1.000 VDC + 0.020, -0.030 VDC. Record this reading.

f. Repeat step d at each of the following test frequencies: 3.0 GHz, 6.0 GHz, 8.2 GHz, 10.0 GHz, 12.4 GHz, 15.2 GHz and 18.0 GHz.

g. Calculate the calibration factors as follows:

(1) Divide the digital multimeter reading recorded at each frequency in step f by the reading recorded at 1.0 GHz in step d or e.

(2) Multiply each result by 100%.

5-7.4 Power Head Models K4240C-5 and A4240C-5. The calibration setup for Power Head Models K4240C-5 and A4240C-5 consists of a calibrated directional coupler, a power head assembly, and Power Meter Model 476-5. To calibrate the Power Heads, proceed as follows:

a. Set the BAT CHK-ON-OFF switch on the Power Meter to OFF. Connect the Power Head-under-test to the Power Meter input connector. Set the BAT CHK-ON-OFF switch to ON. Allow a 15-minute warmup period.

b. Adjust the ZERO control on the Power Meter for a 0 indication on the meter. Turn the CAL FACTOR control to 100%.

c. Connect a digital multimeter to the OUTPUT connector on the Power Meter rear panel. Set the multimeter to the 2 VDC range.

d. Set the RANGE switch on the Power Meter to 1 mW (0 dBm). Using the calibrated signal source, apply a 1.0 mW (0 dBm) signal at each of the frequencies listed below to the Power Head. Record the digital multimeter reading at each frequency.

Model	Calibration Frequencies
K4240C-5	18.0, 22.0, 26.5 GHz
A4240C-5	26.5, 33.0, 40.0 GHz

e. Note the frequency giving the highest digital multimeter reading. This frequency will be the 100% calibration factor reference point. The reading at this frequency must be between 0.970 VDC and 1.020 VDC. If a proper reading is not obtained at this frequency, adjust potentiometer R1 inside the Power Head for a reading of 1.000 VDC + 0.020, -0.030 VDC. Record this reading and repeat step d at the other two frequencies.

f. Calculate the calibration factors as follows:

(1) Divide the digital multimeter reading recorded at each frequency by the reading recorded at the 100% reference frequency determined in step e.

(2) Multiply each result by 100%.

5-8 REPAIR AND REPLACEMENT.

5-8.1 General. Repair and replacement procedures for the Power Meter and the Power Heads are contained in the following paragraphs. When necessary, refer to and use the parts location diagrams contained in Section VII, to supplement the identification and location of parts discussed in the procedures contained in paragraphs 5-8.2, 5-8.3 and 5-8.4.

5-8.2 Repair of Power Meter. Repair of the Power Meter consists of replacement of defective components. When a repair is completed, perform the test and adjustment procedures described in paragraph 5-5.2 to ensure that the Power Meter is operating properly.

5-8.2.1 Replacement of Internal Components. To replace internal components, proceed as follows:

WARNING

Voltages dangerous to life are present in the Power Meter when the AC line cord is connected to a primary power source. Make certain that power is disconnected before opening the Power Meter. Observe all safety precautions while working on energized equipment.

a. At the rear of the Power Meter, remove the four screws that secure the top and bottom covers.

b. At each side of the Power Meter, remove the eight screws that secure the top and bottom covers.

c. Carefully remove the two covers by sliding them to the rear and then away from the Power Meter.

d. The amplifier circuitry (U1, U2, U3) is located within the shielded enclosure behind the RANGE switch assembly. To gain access to this circuit, remove the mounting screws and remove the cover from the shielded enclosure. The power-supply components, except for the power transformer, are located adjacent to the shielded compartment; the power transformer is on the rear panel. Precision range resistors R12 through R15 are located on the RANGE switch assembly.

e. The remaining components are located on the subpanel located behind the front panel.

5-8.2.2 Replacement of Front Panel Components. To replace any of the front panel components, proceed as follows to the extent necessary:

a. Gain access to the interior of the Power Meter as described in paragraph 5-8.2.1.

b. If replacement of any pins on the input connector J1 is required, remove the defective pin(s) from the rear of the connector using a pin insertion/withdrawal tool and carefully noting their positions. Then remove the defective pin(s) from the harness and replace the pin(s), using a crimping tool. Insert the replacement pin(s) in the connector using the pin insertion/withdrawal tool.

c. Snap off the front panel bezel from the top and remove the bezel by sliding it down.

d. Rotate the CAL FACTOR, ZERO and RANGE controls clockwise, and remove their knob caps using a thin screwdriver or knife. The screws that secure the knobs will be visible.

e. While holding the three controls firmly in their clockwise positions, loosen the three screws and remove the knobs.

f. Remove the front panel marking plate.

g. Remove the four screws that secure the front panel to the unit, and carefully pull the panel away. It is now possible to replace input connector J1 and the BAT CHK-ON-OFF (power) switch without further disassembly of the Power Meter.

h. If connector J1 replacement is required, first remove the pins from the rear of the connector using the pin insertion/withdrawal tool and carefully noting their positions. Do not remove the pins from the harness. Then replace the connector and restore the pins using the pin insertion/withdrawal tool.

i. Remove the four screws, on both sides of the unit, that secure the meter assembly to the unit, and carefully pull the meter assembly away from the unit. It is now possible to remove and replace any remaining parts on the meter assembly, including the meter itself.

j. Reassembly is the reverse of disassembly. When reassembling the Power Meter, be sure the harness is restored to its approximate original position. When replacing the front panel knobs, set them to their clockwise positions (CAL FACTOR to 100; align the RANGE switch pointer to the 0.01 mW position) before tightening screws.

5-8.3 Repair of Power Head Model N4240A-5. Repair of Power Head Model N4240A-5 is limited to replacement of a defective tft element. To replace the tft element, refer to Figure 5-1 and proceed as follows:

a. Remove the three screws (1) that secure the Power Head housing (2) to the connector panel (3). Slip housing along the cable away from the Power head assembly.

b. Hold U-Jig (4) bevel side up and slide between plungers (5) and tft' element upper housing (6).

c. Remove the four screws, washers and lockwashers (7) from tft element housing. Carefully lift upper housing away from lower housing (8).

d. After noting orientation of tft element (9) and cover sheets (10, 11), remove and discard them.

e. Carefully place replacement tft element and new cover sheets on guide pins in upper housing. Metallized surface on tft element must face contacts in lower housing.

f. Align upper housing guide pins with corresponding holes in lower housing. Bring housings together.

g. Install screws, washers and lockwashers (7). Tighten screws one turn at a time until the housings are firmly secured.

NOTE

If torque screwdriver is used to secure screws in the tft element housing, set it to 40 inch-ounces.

h. Remove U-jig. Attach housing to Power Head assembly.

i. Recalibrate the Power Head as described in paragraph 5-7.3.

5-8.4 Repair of Power Head Models K4240C-5 and A4240C-5. Repair of Power Head Models K4240C-5 and A4240C-5 is limited to replacement of a defective tft element. To replace the tft element, refer to Figure 5-2 and proceed as follows:

a. Remove the three screws and lockwashers (1) that secure the housing (2) to the flanged waveguide assembly (3). Slip housing along the cable away from the Power Head assembly.

b. Remove the screw and lockwasher (4) that secure the ground lug and black grounding wire to the waveguide flange.

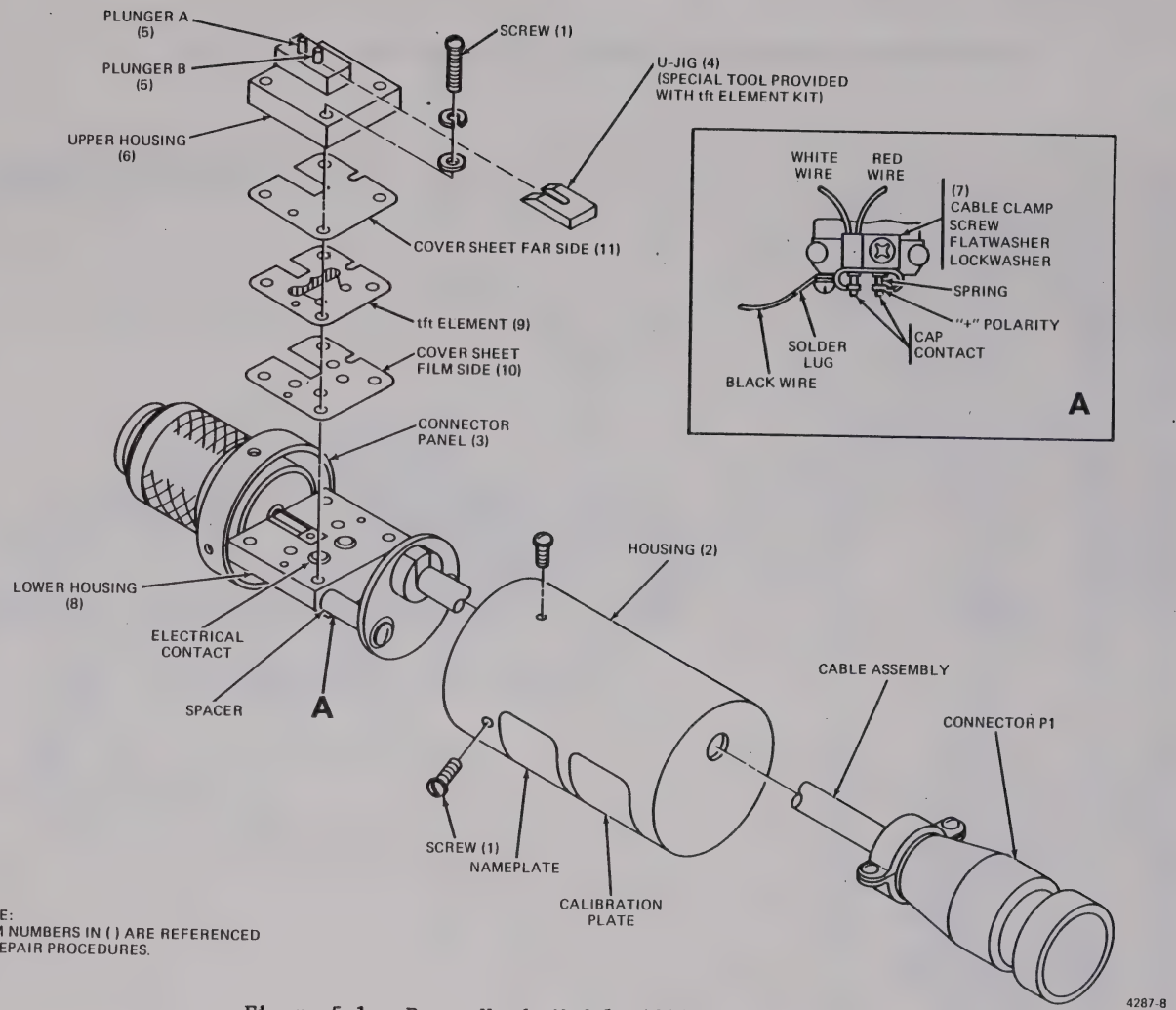


Figure 5-1. Power Head, Model N4240A-5, Exploded View

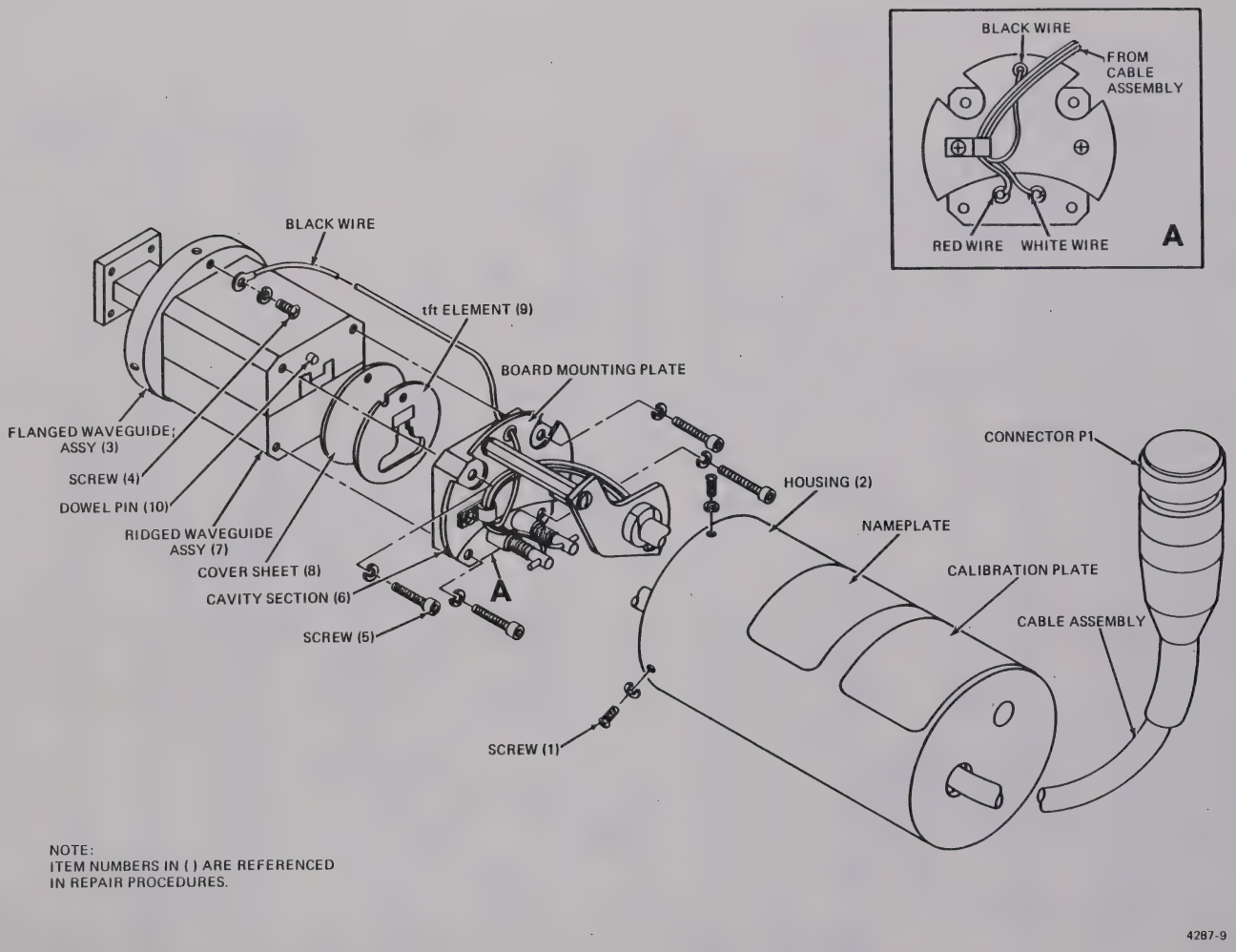


Figure 5-2. Power Head, Models K4240C-5 and A4240C-5, Exploded View

c. Remove the four screws and lockwashers (5) from the cavity section (6). Separate the cavity section from the ridged waveguide assembly (7).

d. Remove tft element (9) and cover sheet (8). Place new tft element and new cover sheet carefully over dowel pins (10) in ridged waveguide assembly (7).

e. Carefully align holes in cavity section (6) with dowel pins in ridged waveguide assembly (7), press together, and install the four screws and lockwashers (5). Tighten one turn at a time until assemblies are firmly secured.

f. Reassemble the Power Head.

g. Recalibrate the Power Head as described in paragraph 5-7.4.

SECTION VI

PREPARATION FOR RESHIPMENT AND STORAGE

6-1 GENERAL.

This section contains the procedures for preparing the Test Set for reshipment or storage. The Test Set is shipped or stored with its major assemblies stowed in the carrying case.

6-2 PREPARATION FOR RESHIPMENT.

To prepare the Test Set for reshipment, proceed as follows:

a. Set the BAT CHK-ON-OFF switch on the front panel of the Power Meter to OFF.

b. Disconnect the AC line cord from the power module on the Power Meter rear panel.

c. Stow the Power Meter, three Power Heads and the AC line cord in the carrying case as shown in Figure 1-1.

d. Secure the two latches on the carrying case.

e. Pack the Test Set in a suitable shipping container; use its original container, if available. Use sufficient packing material to ensure that the Test Set is held securely in place. Seal the container.

f. Mark the container in accordance with MIL-STD-129 for domestic shipment or NAT-STD-2023 for international shipment.

g. Fill out a shipping list and attach it to the outside of the shipping container.

6-3 PREPARATION FOR STORAGE.

To prepare the Test Set for storage, proceed as follows:

a. Perform the procedures contained in paragraph 6-2, steps a through d.

b. Store the Test Set in a dry area having an ambient temperature in the range of -54°C to +85°C.

SECTION VII

PARTS LIST

7-1 GENERAL.

This section contains the parts list and parts location diagrams for the Test Set. This parts list is intended for use in identifying and requisitioning parts. When ordering parts, please indicate your instrument model and serial numbers as well as the applicable parts list data.

7-2 PARTS LIST.

The parts list consists of illustrations and tabular listings for the assemblies and subassemblies of the Test Set (Figures 7-1 through 7-4 and Tables 7-1 through 7-4). A system of indention is used throughout the parts list to show the relationship between the detail parts and the subassemblies, and between the subassemblies and the main assemblies. The parts list is presented in tabular form containing the information given in the following paragraphs.

7-2.1 Figure and Index Number Column. This column provides a cross-reference between the parts list and its associated illustration. The figure number, to which the parts list is keyed, is followed by a dash and appears at the beginning of a listing and at the first line of continuing pages. The index numbers are preceded by a dash and correspond to those numbers on the associated illustration.

7-2.2 Part Number Column. This column contains the manufacturer, vendor, or government standard part number of each component.

7-2.3 Description Column. This column lists the name, and gives the descriptive information for, the assemblies and parts of the Test Set. NHA (next higher assembly) used in this column indicates the next higher assembly, or figure, from which the assembly was used. When a part is vendor supplied, the supply code for that vendor as designated in Cataloging Handbook H4-1 and H4-2, Federal Supply Code for manufacturers appears in parenthesis, following the description of the part.

7-2.4 Quantity Per Assembly Column. This column indicates the quantity per part of the parts required for the assembly or subassembly in which that part appears. REF is used in this column to signify that the part has been previously listed and is being listed at this point for reference only.

7-3 LIST OF MANUFACTURERS

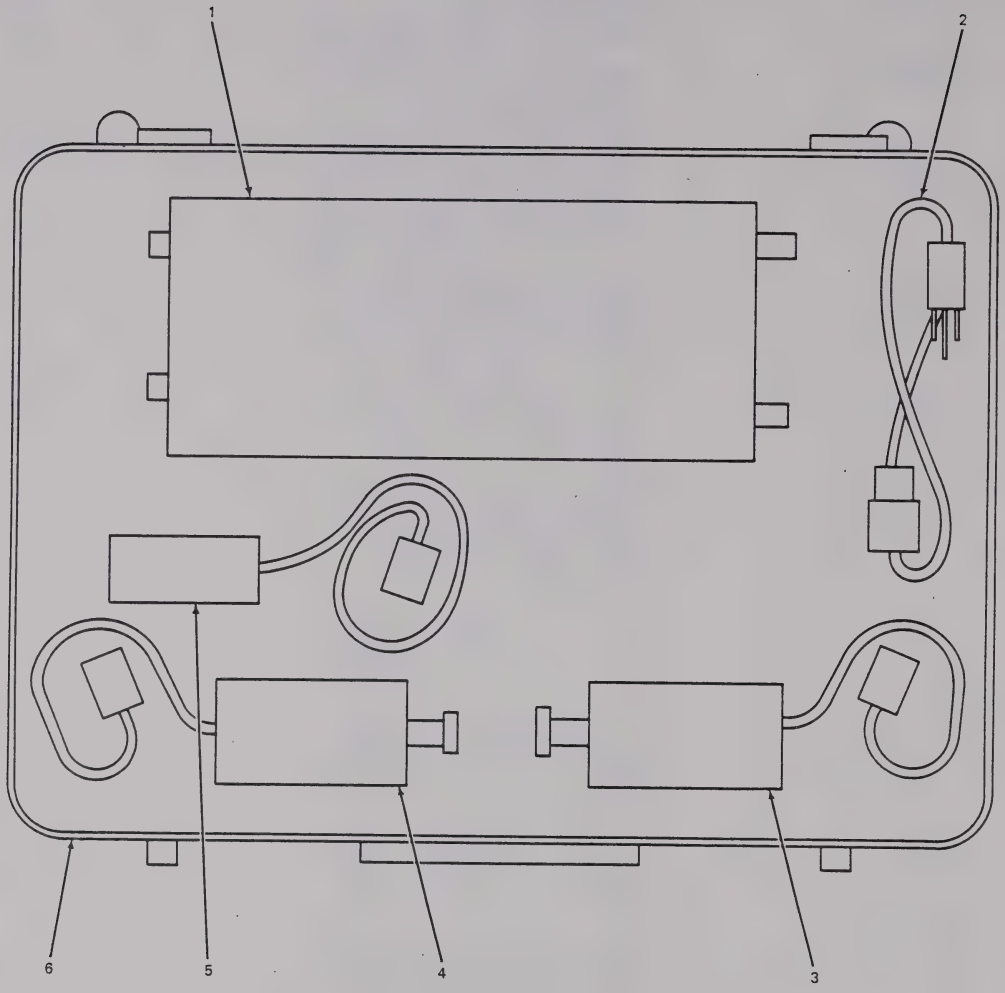
The following is a list of manufacturers and their codes as used in this section.

FSCM	Manufacturer
51506	Accurate Screw Machine Co. 19 Baltimore St. Nutley, NJ 07110
70318	Allmetal Screw Products Co. Inc. 200 Executive Drive Edgewood, NY 11717
70458	Atlantic India Rubber Works Inc. 5701 W. Polk St. Chicago, IL 60607
91506	Augat Inc. P.O. Box 779 33 Perry Ave. Attleboro, MA 02703
57921	Bourns Inc. Precisions/Controls Div. 1200 Columbia Ave. Riverside, CA 92507
21604	Buckeye Stamping Co. 555 Marion Rd. Columbus, OH 43207
02660	Bunker Ramo Corp. Amphenol North American Div. 2801 S. 25th Ave. Broadview, IL 60153
65664	Catamount Manufacturing P.O. Box 720 158 Govenor Dr. Orange, MA 01364
05245	Corcom Inc. 1600 Winchester Rd. Libertyville, IL 60048
91367	Dale Electronics Inc. P.O. Box 609 Columbus, NE 68601

FSCM	Manufacturer
72619	Dialight Corp. North American Philips 1913 Atlantic Ave. Manasquan, NJ 08736
72982	Erie Technological Products Inc. 645 W. 11th St. Erie, PA 16512
14936	General Instrument Corp. Discrete Semi Conductor Div. 600 W. John St. Hicksville, NY 11802
11332	General Microwave Corp. 5500 New Horizons Blvd. Amityville, NY 11701
06860	Gould Inc. Automotive Battery Div. 14500 Nelson City of Industry, CA 91749
81349	Government Specification, Any Manufacturer
28520	Heyman Mfg. Co. P.O. Box 160 147 Michigan Ave. Kenilworth, NJ 07033
77900	Illinois Tool Works Inc. Shakeproof Div. St. Charles Rd. Elgin, IL 60120
59993	International Rectifier Semiconductor Div. 233 Kansas St. El Segundo, CA 90245
83330	Kulka (Dialight Corp.) North American Philips 1913 Atlantic Ave. Manasquan, NJ 08736
84830	Lee Spring Co. Inc. 30 Main St. Brooklyn, NY 11201

FSCM	Manufacturer
2P953	Lemo USA, Inc. P.O. Box 11488 Santa Rosa, CA 95406
4W715	Linear Technology Corp. 1630 Mc Carthy Blvd. Milpitas, CA 95035
71590	Mepco/Centralab North American Philips P.O. Box 858 Highway 20 West Ft. Dodge, IA 50501
76348	Miller Products 29 Warren St. New York, NY 10007
06540	Mite Corp. Amatom Electronic Hardware Div. 446 Blake St. New Haven, CT 06515
12040	National Semiconductor P.O. Box 443 Commerce Drive Danbury, CT 06810
5W952	NIC Components Corp. 6000 New Horizons Blvd. N. Amityville, NY 11701
60046	Power Dynamics Inc. P.O. Box 539 59 Lakeside Ave. West Orange, NJ 07052
23050	Product Components Corp. 30 Lorraine Ave. Mt. Vernon, NY 10553
07933	Raytheon Co. Semiconductor Div. 350 Ellis St. Mountain View, CA 94042
98291	Sealectro - BICC Electronics 40 Lindeman Dr. Trumbull, CT 06611

FSCM	Manufacturer
59270	Selco Products Co. 7580 Stage Road Buena Park, CA 90621
56289	Sprague Electric Co. 87 Marshall St. North Adams, MA 01247
79136	Waldes Kohinoor Inc. 47-16 Austel Place Long Island City, NY 11101
65092	Weston Instrument Div. Sangamo Weston Inc. 614 Freelinghuysen Ave. Newark, NJ 07114
85480	W.H. Brady Co. 727 W. Glendale Ave. Milwaukee, WI 53209
79963	Zierick Mfg. Corp. Radio Circle Mt. Kisco, NY 10549



4287-10

Figure 7-1. Test Set, Model 4037, Parts Location Diagram

Table 7-1. Test Set, Model 4037, Parts List

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-1	18878	TEST SET, MODEL 4037	REF
-1	18856-P1	. POWER METER, MODEL 476-5 . . . . . (SEE FIGURE 7-2 FOR BREAKDOWN)	1
-2	13749-P1	. CORD, LINE, AC	1
-3	18868-G2	. POWER HEAD, MODEL K4240C-5 . . . . (SEE FIGURE 7-3 FOR BREAKDOWN)	1
-4	18868-G1	. POWER HEAD, MODEL A4240C-5 . . . . (SEE FIGURE 7-3 FOR BREAKDOWN)	1
-5	18851-G1	. POWER HEAD, MODEL N4240A-5 . . . . (SEE FIGURE 7-4 FOR BREAKDOWN)	1
-6	9407-G1	. CARRYING CASE.	1

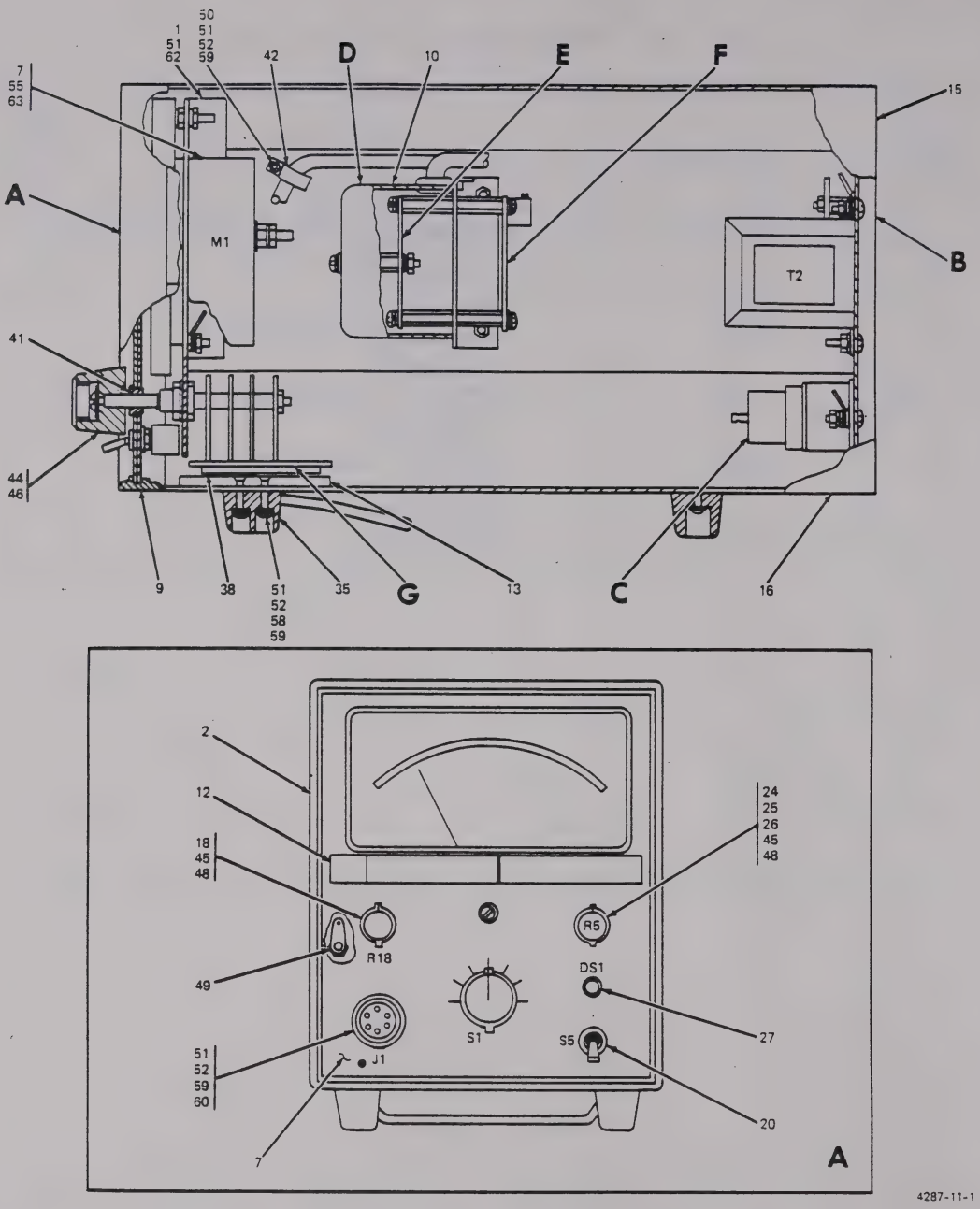


Figure 7-2. Power Meter, Model 476-5, Parts Location Diagram (Sheet 1 of 3)

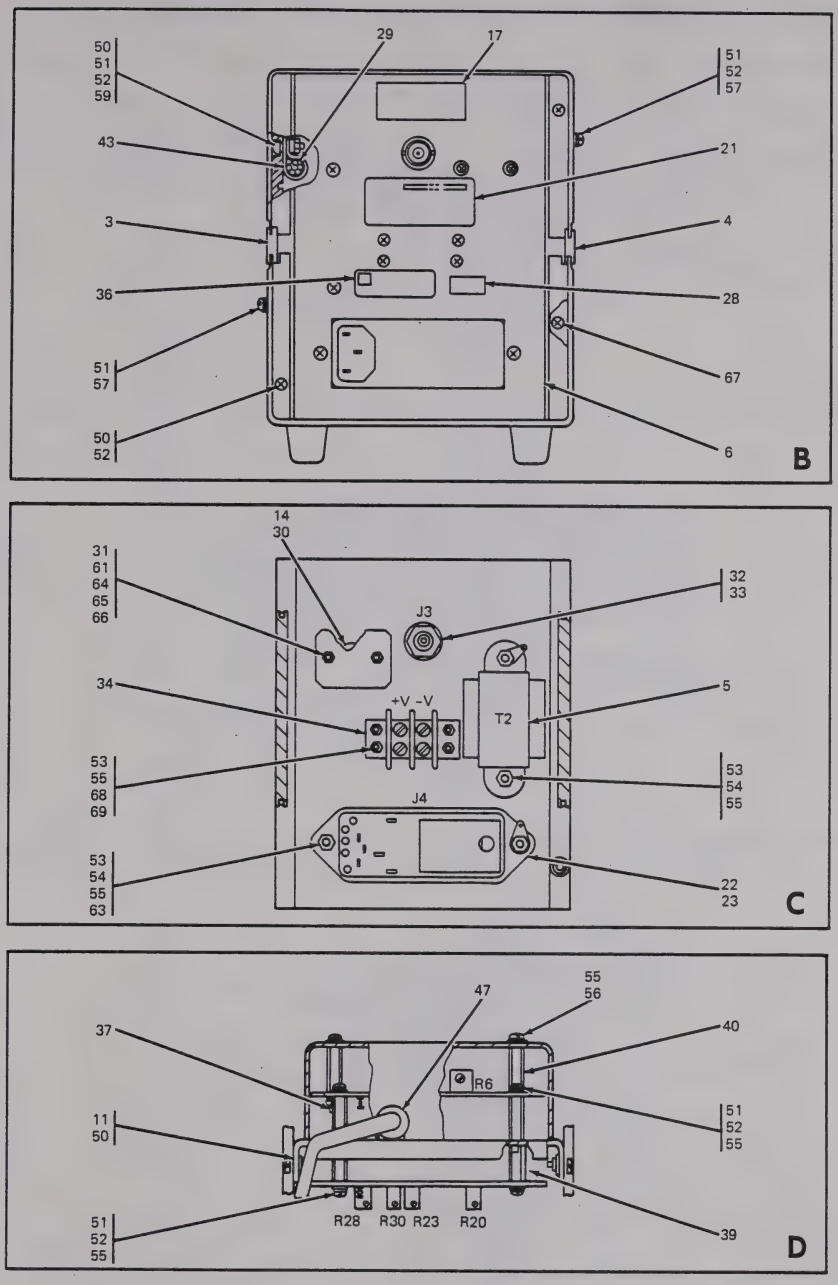


Figure 7-2. Power Meter, Model 476-5, Parts Location Diagram (Sheet 2 of 3)

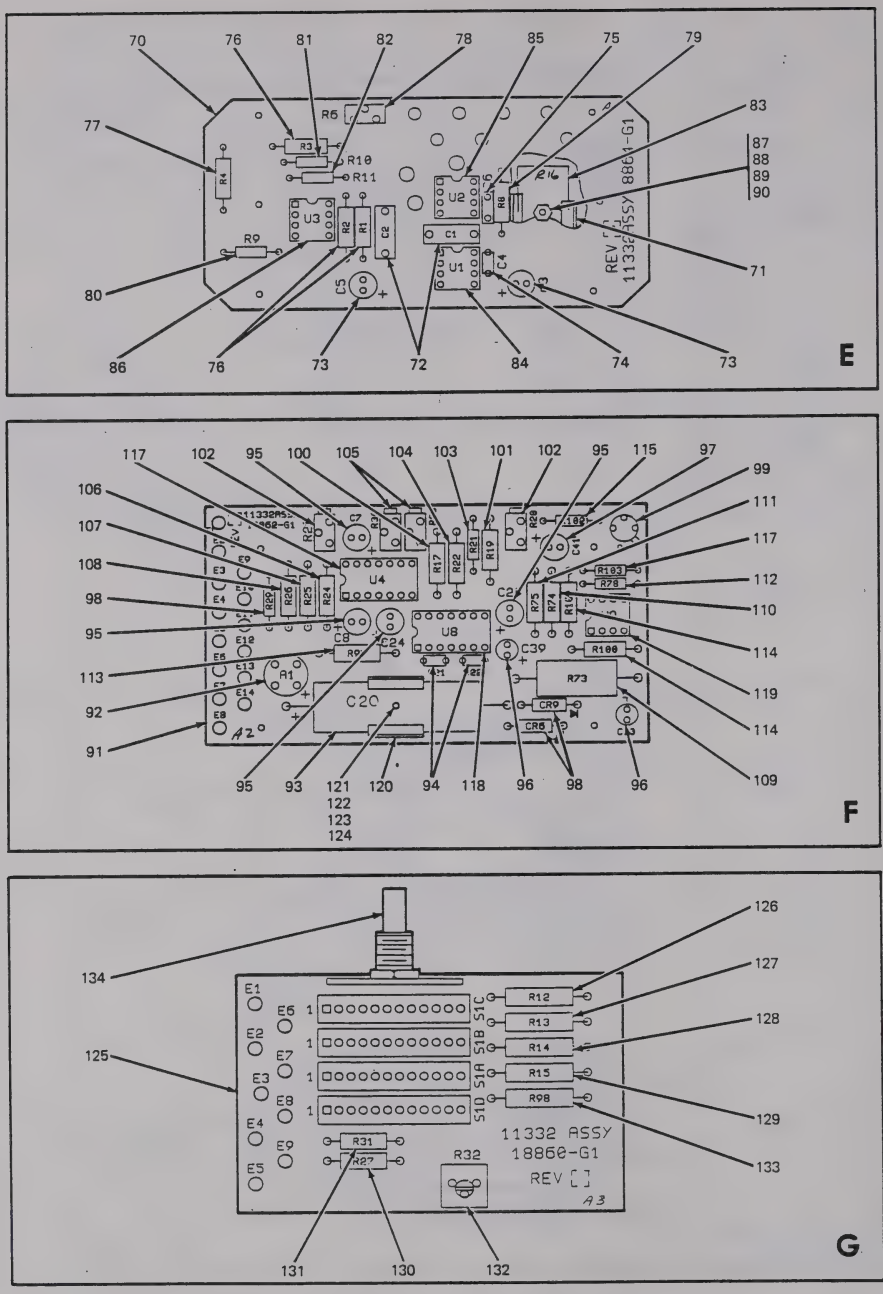


Figure 7-2. Power Meter, Model 476-5, Parts Location Diagram (Sheet 3 of 3)

Table 7-2. Power Meter, Model 476-5, Parts List

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-2	18856-G1	POWER METER, MODEL 476-5 . . . . . (SEE FIG. 7-1 FOR NHA)	REF
-1	7908-P1	. CHASSIS.	1
-2	8280-P1	. BEZEL.	1
-3	18816-P1	. BAR, SIDE.	1
-4	18816-P2	. BAR, SIDE.	1
-5	8332-P1	. TRANSFORMER.	1
-6	18814-P1	. PANEL, REAR.	1
-7	18812-P1	. PANEL, FRONT	1
-8	18818-P1	. METER.	1
-9	18817-P1	. SUB-PANEL, FRONT	1
-10	18855-P1	. HOUSING.	1
-11	18813-P1	. BRACKET.	1
-12	7910-P5	. NAMEPLATE.	1
-13	18844-P1	. PLATE, REINFORCEMENT	1
-14	18838-P1	. SHIELD	1
-15	18815-P1	. COVER, TOP	1
-16	19134-G1	. COVER, BOTTOM - RIVETED. . . . . ASSEMBLY	1
-17	W041	. LABEL, CALIBRATED (11332 . . . . . P/N 18875-P1) (85480)	1
-18	8330-P1	. RESISTOR	1
-19	8343-P1	. CONNECTOR.	1
-20	8329-P1	. SWITCH	1
-21	18866-P4	. LABEL, WARRANTY.	1
-22	SEFM4	. POWER MODULE (11332. . . . . P/N 16439-P1) (05245)	1
-23	313.100	. FUSE, 0.1 AMP, SLO-BLO . . . . . (11332 P/N 17203-P2) (LITTEL FUSE)	1
-24	19109-G1	. RESISTOR SUBASSEMBLY, ... VARIABLE, MODIFIED	1
-25	3540S-1-203	. . RESISTOR (11332 P/N 18881-P1). . (57921)	1
-26	19119-P1	. . PIN, DOWEL	1
-27	559-0101-001	. LED, RED (11332 P/N 18882-P2). . . (72619)	1
-28	4194-57	. PLATE, IDENTIFICATION.	1
-29	18902-1	. HARNESS ASSEMBLY	1
-30	SO-170	. THERMOSTAT (11332. . . . . P/N 19013-P1) (59270)	1
-31	9726-SS-0256-7	. STANDOFF (11332 P/N 19012-P1). . . (06540)	2
-32	227169-8	. CONNECTOR (11332 . . . . . P/N 14104-P1) (02660)	1

Table 7-2. Power Meter, Model 476-5, Parts List - Continued

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-2-33	227223-1	. BUSHING (11332 P/N 14105-1). . . . (02660)	1
-34	600-2	. BLOCK, TERMINAL (11332 . . . . . P/N 17163-P1) (75382)	1
-35	MP40008-7	. TILT STAND (11332. . . . . P/N 18898-P1) (21604)	1
-36	11005-1	. PLATE, IDENTIFICATION.	1
-37	9732-SS-0440-7	. STANDOFF (11332 P/N 18891-P1). . . (06504)	4
-38	18925-P1	. CUSHION.	3
-39	8108-SS-0440-7	. STANDOFF (11332 P/N 18890-P1). . . (06504)	4
-40	9723-N-0440-0	. STANDOFF (11332. . . . . P/N 17134-P11) (06504)	4
-41	9450-P1	. BUSHING.	1
-42		. CLAMP, CABLE (11332. . . . . P/N 14378-P1) ( )	1
-43	5/16-2NA	. CLAMP, CABLE (11332. . . . . P/N 17616-P3) (65664)	2
-44	2315311	. KNOB (11332 P/N 18903-P1). . . . . (60046)	1
-45	18904-P1	. KNOB	2
-46	3021011	. CAP (11332 P/N 10905-P1) . . . . . (60046)	1
-47	263	. GROMMET (11332 P/N 18924-P1) . . . . (70458)	1
-48	3015011	. CAP (11332 P/N 18906-P1) . . . . . (60046)	1
-49	2104-06-00	. LUG, TERMINAL (11332 . . . . . P/N 15280-P1) (77900)	3
-50	MS51957-15	. SCREW (81349).	11
-51	MS15795-803	. WASHER (81349)	39
-52	MS35338-135	. WASHER (81349)	35
-53	MS51957-30	. SCREW (81349).	8
-54	MS15795-805	. WASHER (81349)	4
-55	MS35338-136	. WASHER (81349)	13
-56	MS51957-26	. SCREW (81349).	2
-57	MS51957-14	. SCREW (81349).	24
-58	MS24693-C7	. SCREW (81349).	4
-59	MS35649-244	. NUT (81349).	11
-60	MS24693-C4	. SCREW (81349).	4
-61	MS35338-134	. WASHER (81349)	2
-62	MS51957-17	. SCREW (81349).	4
-63	MS35649-264	. NUT (81349).	8
-64	MS35649-224	. NUT (81349).	2

Table 7-2. Power Meter, Model 476-5, Parts List - Continued

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-2-65	MS15795-802	. WASHER (81349)	4
-66	MS51957-3	. SCREW.	2
-67	No Number	. SCREW, FLAT, TYPE F, SELF TAP. . . # 4-40 X .38L (11332 P/N 19120-P1) (70318)	8
-68	NAS620C-6	. WASHER (81349)	4
-69	NAS671C-6	. NUT (81349).	4
	18864-G1	. AMPLIFIER PRINTED WIRING . . . . . BOARD ASSEMBLY, A1	1
-70	18865-G1	. . BOARD, PRINTED WIRING.	1
-71	6014-6A	. . CLAMP (11332 P/N 15292-P1) . . . (91506)	1
-72	NRM104K100	. . CAPACITOR (11332 . . . . . P/N 18887-P1) (5W952)	2
-73	199D106X0025CA1	. . CAPACITOR (11332 . . . . . P/N 18888-P1) (56289)	2
-74	CK05BX221K	. . CAPACITOR (81349).	1
-75	CK06BX105K	. . CAPACITOR (81349).	1
-76	RN55C1003F	. . RESISTOR (81349)	3
-77	RN55C80R6F	. . RESISTOR (81349)	1
-78	3386H-1-201	. . RESISTOR (11332. . . . . P/N 18886-P1) (57921)	1
-79	RN55C3012F	. . RESISTOR (81349)	1
-80	RC07GF102J	. . RESISTOR (81349)	1
-81	RC076F101J	. . RESISTOR (81349)	1
-82	RC07GF103J	. . RESISTOR (81349)	1
-83	8326-P1	. . RESISTOR	1
-84	LTC1052CN8	. . INTEGRATED CIRCUIT . . . . . (11332 P/N 18892-P1) (37964)	1
-85	LT1028CN8	. . INTEGRATED CIRCUIT . . . . . (11332 P/N 17726-P1) (37964)	1
-86	LM741-CN	. . INTEGRATED CIRCUIT . . . . . (11332 P/N 17251-P1) (12040)	1
-87	MS51957-15	. . SCREW (81349).	1
-88	MS35338-135	. . WASHER (81349)	1
-89	MS15795-803	. . WASHER (81349)	1
-90	MS35649-244	. . NUT (81349).	1
	18862-G1	. POWER SUPPLY PRINTED WIRING. . . . BOARD ASSEMBLY, A2	1
-91	18863-G1	. . BOARD, PRINTED WIRING.	1
-92	W04M	. . RECTIFIER, BRIDGE (11332 . . . . P/N 14045-P1) (14936)	1

Table 7-2. Power Meter, Model 476-5, Parts List - Continued

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-2-93	TUA-1227	. . CAPACITOR (11332 P/N 18889-P1) (56289)	1
-94	CK05BX102K	. . CAPACITOR (11332 P/N 18899-P1) (72982)	2
-95	199D106X0025CA1	. . CAPACITOR (11332 P/N 18888-P1) (56289)	4
-96	199D105X0035AA1	. . CAPACITOR (11332 P/N 18893-P1) (56289)	2
-97	199D226X0016DA1	. . CAPACITOR (11332 P/N 18894-P1) (56289)	1
-98	10D2	. . DIODE (11332 P/N 17199-P2) (59993)	2
-99	2N4393	. . TRANSISTOR (81349)	1
-100	RN55C3741F	. . RESISTOR (81349)	1
-101	RN55C5901F	. . RESISTOR (81349)	1
-102	32962-1-501	. . RESISTOR (11332. P/N 18895-P1) (57921)	2
-103	RC07GF471J	. . RESISTOR (81349)	2
-104	RN55C3651F	. . RESISTOR (81349)	1
-105	32962-1-103	. . RESISTOR (11332. P/N 18897-P1) (57921)	2
-106	RN55C2001F	. . RESISTOR (81349)	1
-107	RN55C1301F	. . RESISTOR (81349)	1
-108	RN55C4121F	. . RESISTOR (81349)	1
-109	RC42GF100J	. . RESISTOR (81349)	1
-110	RN55C7152F	. . RESISTOR (81349)	1
-111	RN55C1782F	. . RESISTOR (81349)	1
-112	RC07GF101J	. . RESISTOR (81349)	1
-113	RC206F152J	. . RESISTOR (81349)	1
-114	RN55C1002F	. . RESISTOR (81349)	2
-115	RC07GF435J	. . RESISTOR (81349)	1
-116	RC07GF225J	. . RESISTOR (81349)	1
-117	LM747CN	. . INTEGRATED CIRCUIT (11332 P/N 17043-P1) (12040)	1
-118	RC4194D	. . INTEGRATED CIRCUIT (11332 P/N 17427-P1) (07933)	1
-119	LM741CM	. . INTEGRATED CIRCUIT (11332 P/N 17251-P1) (12040)	1
-120	6014-6A	. . CLAMP (11332 P/N 15292-P1) (91506)	1
-121	MS51957-15	. . SCREW (81349).	1
-122	MS15795-803	. . WASHER (81349)	1

Table 7-2. Power Meter, Model 476-5, Parts List - Continued

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-2-123	MS35649-244	. . NUT (81349).	1
-124	MS35338-135	. . WASHER (81349)	1
	18860-G1	. RANGE SWITCH PRINTED WIRING. . . . BOARD ASSEMBLY, A3	1
-125	18861-G1	. . BOARD, PRINTED WIRING.	1
-126	CMF60T2-2317 ±0.1%	. . RESISTOR (11332. . . . . P/N 18885-P1) (91367)	1
-127	CMF60T2-20.9K ±0.1%	. . RESISTOR (11332. . . . . P/N 18885-P2) (91367)	1
-128	CMF60T2-209.4K ±0.1%	. . RESISTOR (11332. . . . . P/N 18885-P3) (91367)	1
-129	CMF60T2-7.094M ±0.1%	. . RESISTOR (11332. . . . . P/N 18885-P4) (91367)	1
-130	RN55C2872F	. . RESISTOR (81349)	1
-131	RN55C8660F	. . RESISTOR (81349)	1
-132	3386P-1-201	. . RESISTOR (11332. . . . . P/N 18879-P1) (57921)	1
-133	CMF60T2-2.37K ±0.1%	. . RESISTOR (11332. . . . . P/N 18885-P5) (91367)	1
-134	18819-P1	. . SWITCH	1

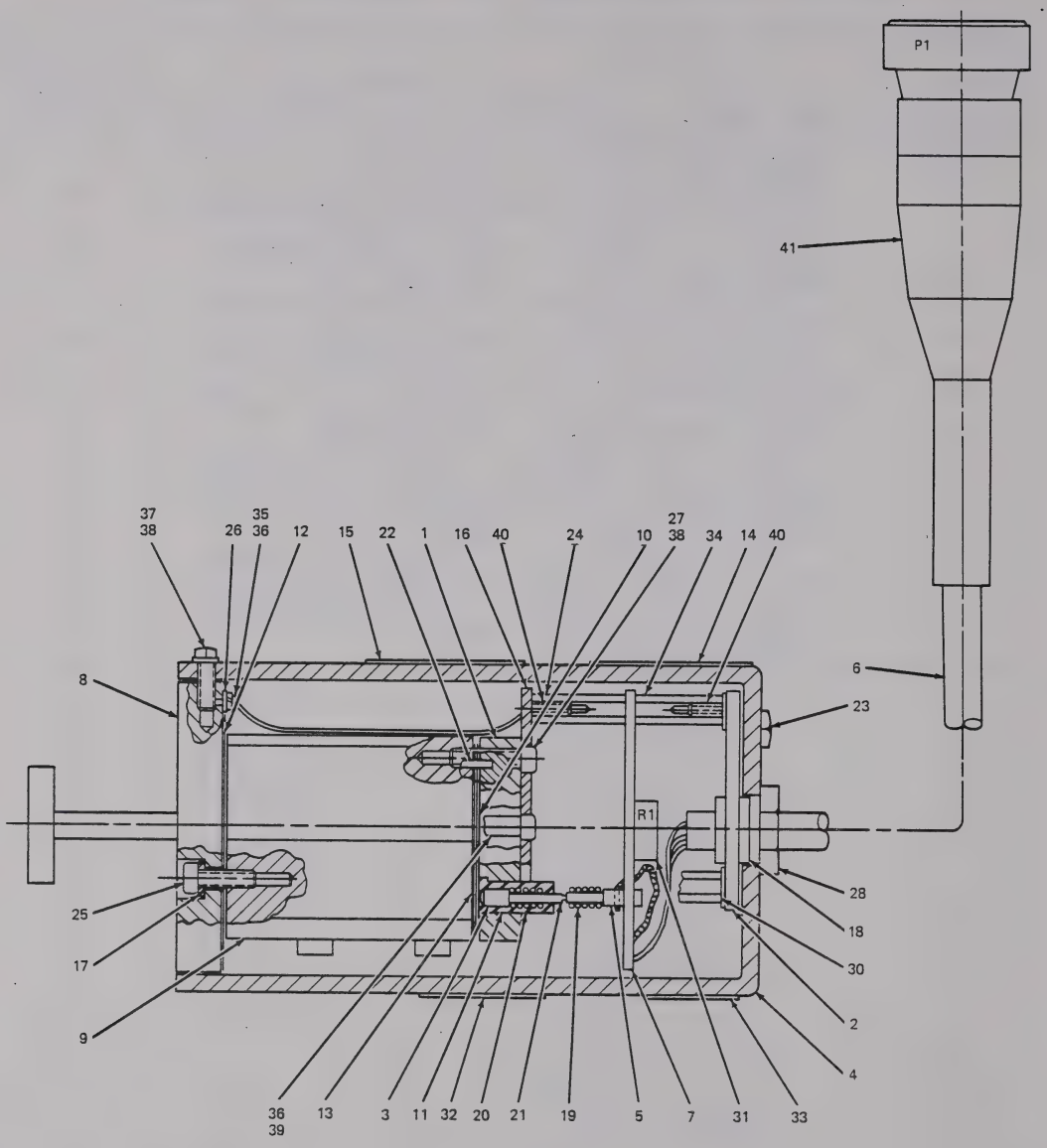


Figure 7-3. Power Head, Models A4240C-5 and K4240C-5, Parts Location Diagram

Table 7-3. Power Head, Models A4240C-5 and K4240C-5, Parts List

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-3	18868-G1*	POWER HEAD, MODELS A4240C-5, K4240C-5 (SEE FIG. 7-1 FOR NHA)	REF
	18868-G2**	POWER HEAD, MODEL K4240C-5 (SEE FIG. 7-1 FOR NHA)	REF
-1	4487-G1*	. CAVITY ASSEMBLY.	1
	4490-G1**	. CAVITY ASSEMBLY.	1
	4347-P2*	. . SPRING	1
	4347-P1**	. . SPRING	1
	14390-P1	. . SCREW.	1
	3300-P1	. . CAVITY	1
-2	4423-P1	. BRACKET, CABLE MOUNTING.	1
-3	3051-P1	. CONTACT, ELECTRICAL.	1
-4	3983-G2	. ENCLOSURE ASSEMBLY	1
-5	3053-P1	. CAP, ELECTRICAL.	2
-6	2978-P1	. CABLE.	1
-7	4417-G1	. PRINTED WIRING BOARD SUBASSEMBLY	1
-8	3112-G4*	. WAVEGUIDE ASSEMBLY	1
	3112-63**	. WAVEGUIDE ASSEMBLY	1
	15992-P1*	. . FLANGE, COVER.	1
	15641-P1**	. . FLANGE, COVER.	1
	3314-P1*	. . WAVEGUIDE SECTION.	1
	3315-P1**	. . WAVEGUIDE SECTION.	1
	4087-P1*	. . FLANGE, ENCLOSURE.	1
	4088-P1**	. . FLANGE, ENCLOSURE.	1
-9	4084-G1*	. WAVEGUIDE ASSEMBLY, RIDGED	1
	3298-G1**	. WAVEGUIDE ASSEMBLY, RIDGED	1
	3294-P1*	. . WAVEGUIDE SECTION, RIDGED.	1
	3295-P1**	. . WAVEGUIDE SECTION, RIDGED.	1
	3296-P1*	. . WAVEGUIDE SECTION, COVER	1
	3297-P1**	. . WAVEGUIDE SECTION, COVER	1
	16000-P1	. . SCREW.	4
-10	4322-G1*	. ELEMENT, TFT	1
	4322-G2**	. ELEMENT, TFT	1
-11	3050-P1	. BUSHING, INSULATOR	2
-12	4314-P2*	. INSULATOR.	1
	4314-P1**	. INSULATOR.	1
-13	4323-P1	. COVER, PROTECTIVE.	1
-14	8396-P3*	. PLATE, CALIBRATION	1
	8396-P5**	. PLATE, CALIBRATION	1

* USED ON 18868-G1 ONLY
** USED ON 18868-G2 ONLY

Table 7-3. Power Head, Models A4240C-5 and K4240C-5, Parts List - Continued

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-3-15	4358-P7	. NAMEPLATE.	1
-16	4434-P1	. PLATE, BOARD MOUNTING.	1
-17	4492-P1	. BUSHING, INSULATING.	4
-18	SR-5P-4	. STRAIN RELIEF (11332 . . . . . P/N 13605-P1) (28520)	1
-19	CI-010B-4MW	. SPRING (11332 P/N 14369-P1). . . . (84830)	2
-20	LC-018A-2MW	. SPRING (11332 P/N 14370-P1). . . . (84830)	2
-21	45133-6-MD	. RING, RETAINING (11332 . . . . . P/N 13606-P1) (79136)	2
-22	5956-1	. PIN, DOWEL (11332 P/N 15995-1) . . (70318)	2
-23	14393-P1	. PLUG, BUTTON	1
-24	8114-SS-0256-7*	. STANDOFF (11332 P/N 17106-P2). . . (06540)	3
	8108-SS-0256-7**	. STANDOFF (11332 P/N 18877-P1). . . (06540)	3
-25	MS16995-10	. SCREW (81349).	4
-26	416-093	. LUG, TERMINAL (11332 . . . . . P/N 13609-P1) (79963)	1
-27	16005-P1	. SCREW.	4
-28	15608-P1	. PLUG, BUTTON	1
-29	120-060-A-22	. WASHER (11332 P/N 15997-P1). . . . (37365)	1
-30	40.2 NYLON	. WASHER (11332 P/N 15998-P1). . . . (23050)	2
-31	3292P-1-203	. RESISTOR (11332 P/N 18867-P1). . . (57921)	1
-32	18866-P2*	. LABEL, WARANTEE.	1
	18866-P3**	. LABEL, WARANTEE.	1
-33	W041	. LABEL, CALIBRATED (11332 . . . . . P/N 18875-P1) (85480)	1
-34	9729-SS-0256-7	. STANDOFF (11332 P/N 18876-P1). . . (06540)	2
-35	CS211-83	. SCREW.	1
-36	CS262-1	. WASHER	3
-37	CS211-45	. SCREW.	3

* USED ON 18868-G1 ONLY
** USED ON 18868-G2 ONLY

Table 7-3. Power Head, Models A4240C-5 and K4240C-5, Parts List - Continued

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-3-38	CS262-2	. WASHER	7
-39	CS211-24	. SCREW.	2
-40	CS212-24	. SCREW.	5
-41	8376-P1	. CONNECTOR.	1

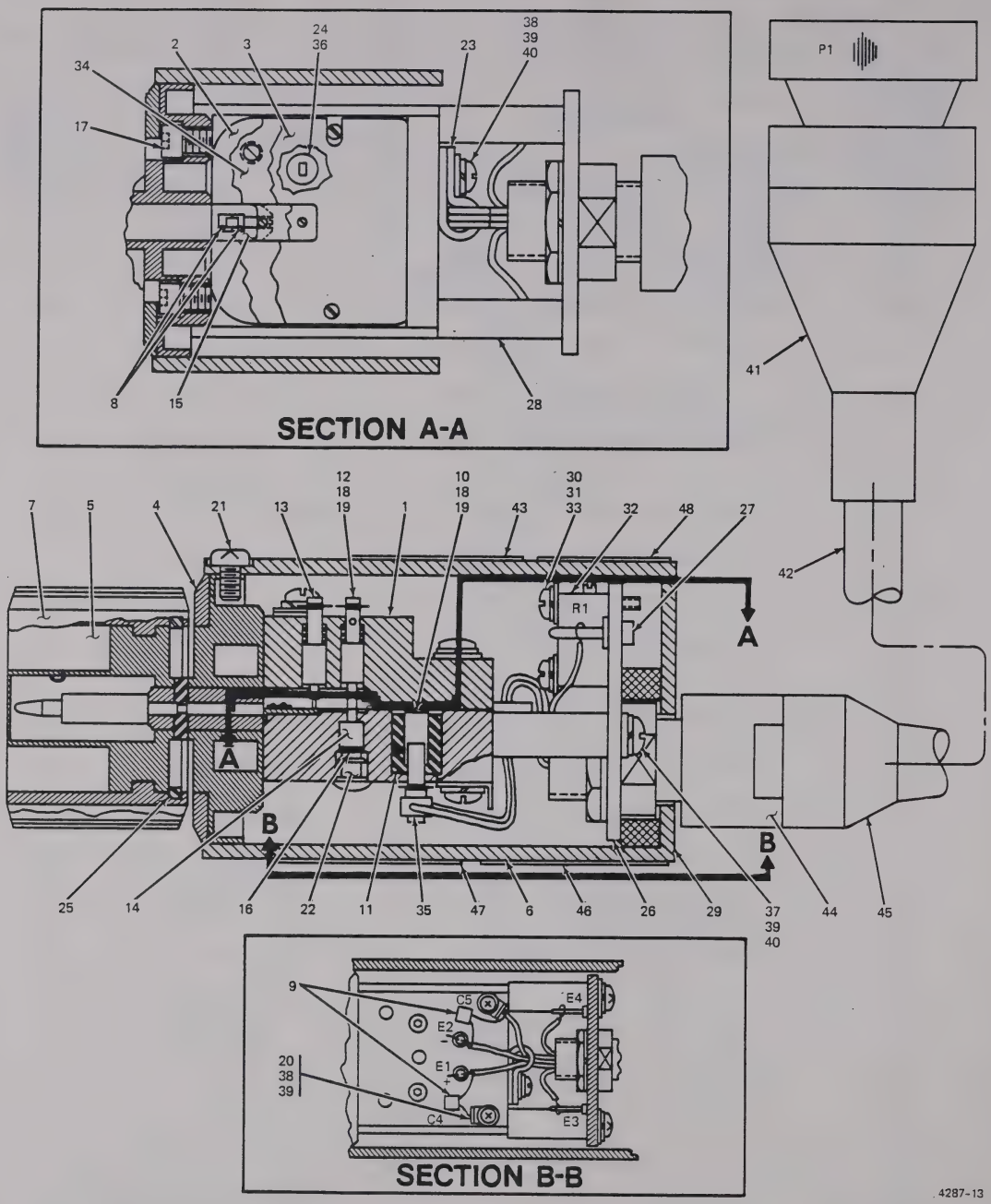


Figure 7-4. Power Head, Model N4240A-5, Parts Location Diagram

Table 7-4. Power Head, Model N4240A-5, Parts List

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-4	18851-G1	POWER HEAD, MODEL N4240A-5 (SEE FIG. 7-1 FOR NHA)	REF
-1	6432-G1	. HOUSING ASSEMBLY	1
	6433-P3	. . HOUSING, LOWER	1
	6434-P4	. . HOUSING, UPPER	1
	5956-1	. . PIN, DOWEL (11332 P/N 14385-P1) (70318)	2
	CS211-26	. . SCREW	4
	CS262-1	. . WASHER	4
	CS260-2	. . WASHER	4
-2	6420-P3	. COVER, PROTECTIVE	1
-3	6420-P5	. COVER, PROTECTIVE	1
-4	8040-P1	. INSULATOR	1
-5	8148-G1	. CONNECTOR, COAX	1
-6	14636-P2	. HOUSING	1
-7	4507-G1	. NUT ASSEMBLY, MOULDED	1
-8	5878-P3	. CAPACITOR	2
-9	CW15C472M	. CAPACITOR (11332 P/N 15613-P1) (88557)	2
-10	6443-P3	. CONTACT	2
-11	6444-P3	. BUSHING	2
-12	6445-P3	. PLUNGER	1
-13	6445-P5	. PLUNGER	1
-14	6447-P3	. ROD, HEAT SINK	1
-15	6448-P3	. STRIPLINE	1
-16	13648-P1	. WASHER	1
-17	MS16995-9	. SCREW (81349)	2
-18	X5133-6-MD	. RING, RETAINING (11332 P/N 13606-P1) (79136)	4
-19	CT-008B-1SS	. SPRING (11332 P/N 13607-1) (84830)	6
-20	416-093	. LUG, TERMINAL (11332 P/N 13609-P1) (79963)	2
-21	MS51957-1	. SCREW (81349)	3
-22	AN565EC6H2	. SCREW (81349)	1
-23	3/32-2NA	. CLAMP, CABLE (11332. P/N 17616-P1) (65664)	1
-24	14293-G1	. BELLOWS ASSEMBLY	2
-25	MS90136-1	. WASHER	1
-26	13695-P1	. PLATE, MOUNTING	1
-27	003-1009-00-0-479	. TERMINAL, STANDOFF (11332. P/N 14085-P1) (98291)	2
-28	9213-SS091-7	. SPACER (11332 P/N 14086-P1) (06540)	2
-29	16776-P1	. GASKET	1

Table 7-4. Power Head, Model N4240A-5, Parts List - Continued

Figure & index no.	Part number	Description 1 2 3 4 5 6 7	Qty per assy
7-4-30	MS15795-801	. WASHER (81349)	2
-31	15401-P1	. WASHER	2
-32	32826-1-203	. RESISTOR (11332 P/N 14081-P1). . . (65092)	1
-33	15400-P1	. SCREW.	2
-34	7022-G3	. TFT ELEMENT.	1
-35	12603-P1	. CAP, ELECTRICAL.	2
-36	AN565AC8H2	. SCREW (81349).	2
-37	GS211-212	. SCREW.	2
-38	CS211-23	. SCREW.	3
-39	CS262-1	. WASHER	5
-40	CS260-1	. WASHER	3
-41	8376-P1	. CONNECTOR.	1
-42	2978-P1	. CABLE.	1
-43	18866-P1	. LABEL, WARRANTY.	1
-44	RJ24FL203	. LEAD THRU, W/COLLET (11332 . . . . P/N 16672-P1) (65092)	1
-45	FIB192-N	. RELIEF, BEND (11332. . . . . P/N 16849-P1) (2P953)	1
-46	8396-P6	. PLATE, CALIBRATION	1
-47	10845-P7	. NAMEPLATE.	1
-48	W041	. LABEL, CALIBRATED (11332 . . . . . P/N 18875-P1) (85480)	1

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